The Electrical World.

VOL. XXVIII. NEW YORK, AUGUST 22, 1896. No. 8.

PUBLISHED EVERY SATURDAY BY

THE W. J. JOHNSTON COMPANY,

253 Broadway, New York.

Established 1874. Incorporated 1889.

Telephone Call: Cortlandt 924. Cable Address: "Electrical," New York

New England Office, 620 Atlantic Ave., Boston.

Western Office, 936 Monadnock Block, Chicago.

Philadelphia Office, 927 Chestnut Street.

SUBSCRIPTION IN ADVANCE, ONE YEAR, $3.00,
in the United States, Canada or Mexico; other foreign countries, $6

In requesting your address changed give OLD as well as new address.

Now in its third decade, THE ELECTRICAL WORLD is the Pioneer Electrical Journal of America, and has well maintained its lead. It has the largest Circulation of any electrical periodical, and is the best Advertising Medium.

THE ELECTRICAL WORLD'S Advertising Rates are much lower than those of any other similar publication, circulation considered, and vary according to space, position and number of insertions. Quotations promptly furnished.

Address and make drafts, orders, etc., payable to

THE ELECTRICAL WORLD,

253 Broadway, New York.

VOL. XXVIII. NEW YORK, AUGUST 22, 1896. No. 8.

CONTENTS.

Editorials. 213
Convention of the Association of Edison Illuminating Companies.. 214
American Association for the Advancement of Science—Forty-fifth Meeting. By Wm. H. Hale, Ph. D. 215
The Gebrueder Naglo Equipment for Telephone Exchanges—System Hess-Raverot-West. By Jul. H. West. 217
Use of Photography in Data Collections. By Reginald A. Fessenden. 222
The Midland Railway of Staten Island. 225
Meeting of the Chicago Electrical Trade. 227
Digest of Current Electrical Literature, compiled by Carl Hering. 228
New Book. 232
Direct-Current Arc Lamp. 233
Wire Reel. 233
Improved Telephone Switchboard. 233
Alternating-Current Instruments. 234
Röntgen-Ray Apparatus. 234
A Heavy Train. 234
Compression Shaft Coupling. 234

DEPARTMENTS:

Financial Intelligence. 235
Special Correspondence. 235
General News. 236
Personal Notes. 238
Obituary Notes. 239
Trade and Industrial Notes. 239
Illustrated Record of Electrical Patents. 239

THE NEED FOR AN IMPROVED TROLLEY.

It is generally recognized that the trolley is a weak point in an electric railway equipment, yet no determined effort has been made to meet this deficiency. This weakness consists in the absence of that most important requisite in a device of this character—reliability. The standard trolley, now almost universally used, is prone to jump the trolley wire at any moment and render the car helpless for the time being. This happens so often that its occurrence has of late almost ceased to excite any apprehension or comment. It is frequently the case that needed and imperative reforms are neglected through sheer indifference, and not until an unavoidable accident happens is any real effort put forth to remove the cause. Any one at all observing cannot fail to discern the possible danger brought about by the trolley jumping the wire when the car is upon a grade, or of a car getting stalled from like cause while crossing a railway track. Two serious accidents resulting from these very circumstances have occurred in the immediate vicinity of New York within a short time, proving that these fears are well founded. A few weeks ago a car on a Brooklyn road ran backward down a hill by reason of the trolley jumping the wire, and only recently a car slipped its trolley connection while crossing a railway track, and in this helpless condition was struck by a train. Apart from the question of blame for these accidents, they demonstrate most emphatically the danger to which many lives are daily exposed in cities and suburbs through the uncertainty of the trolley staying where it belongs. If an improvement in electric railway equipments was ever needed it is certainly presented here, and it is assuring that one concern has produced a trolley device that is designed among other things to avoid just such accidents. The solution is not a question involving great engineering skill, but simply a change from existing practice.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The annual meeting of that now venerable body, considered from the standpoint of American societies, the American Association for the Advancement of Science, is to be held in Buffalo during the week commencing Aug. 24. The parent society was organized in April, 1840, eight years after its prototype, the British Association, and was originally known as the American Association of Geologists. In 1842 the name was changed to the American Association of Geologists and Naturalists, and in September, 1848, in order to more harmoniously comply with the various branches of science as represented in its membership the name was changed to that which it now retains. The membership of the association, slightly below 2000, is composed of fellows and members, the former being those who have contributed in some way to the advancement of science. In looking over the programme of the coming meeting, which will be found in another column of this issue, it will be noted that the society is by no means confined to a discussion of subjects relating to pure science alone, but includes in its scope the most advanced problems of applied science. The list of electrical papers to be read before the Physics Section includes several of particular interest and importance. Although the American Association has had in the past and now includes in its list of members the most advanced thinkers in science, yet it has not been so fortunate as the British Association in having brought before its meetings questions destined to mark an epoch in scientific progress. The association has failed in the past to take that leading position so long maintained by its British cousin. The zealous desire of Englishmen to read papers has not been carried perhaps to the same extent in America, but

the programme of the present meeting, including as it does several hundred papers, gives evidence to the fact that American scientists are not lacking in this particular respect. This certainly offers as far as number is concerned a splendid example to other organized bodies in which no apparent reason exists for the reticence displayed by so many of their members. In conjunction with the meeting of the association there will be held meetings of several affiliated societies. It has been considered by some that these meetings have detracted from rather than enhanced the importance of the main body, although it is recognized that the presence of their members adds an important influence to the general meeting. In consequence of this a new experimental departure will be made by making some of the minor meetings more of a business nature rather than for the reading of papers, thus bringing the papers before the main association. This experiment is certainly to be regarded with favor and will doubtless in the future be generally adopted by most of the other affiliated societies.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION.

The fourth annual meeting of the Society for the Promotion of Engineering Education, the programme of which appeared in our last issue, promises to be the most important of the society's short existence. The questions discussed before this body have a most important influence upon future engineering training, and therefore upon future engineering development. Few indeed appreciate the import of this influence on the progress of civilization. This society was founded in 1893, for the purpose of enhancing the profession of engineering teaching, both in its importance and influence. The value of an engineering education has been an oft-mooted question, but one which finally resolves itself into the best solution of the problem of equipping students for engineering pursuits. None will maintain that the graduate is a finished engineer or that shop practice has made of him an accomplished mechanic, or, in fact, that he is furnished with more than a fundamental basis upon which to broaden his ideas and enhance his reputation in his chosen vocation. The engineer of the future must be liberally educated to the extent of not being narrow minded, yet in this age of increasing specialization he will naturally be forced to concentrate his efforts upon one particular branch. The educational school should therefore lay before the student those subjects calculated best to fulfill his inclinations. Superfluous studies should not be forced upon him, yet his immature experience should be duly considered. His time should not be wasted in making tests undertaken by the head of the department for a monetary consideration, or by attempting to teach him to converse in one or more foreign languages within the space of two or three years. The former has been a prime evil in several institutions, while the latter is one of the greatest of their existing fallacies. The right on the part of teachers to accept remunerative employment aside from college duties cannot be denied. Not a few of our best teachers are in a position which makes them entirely independent of the institutions which they represent, an independence which is maintained by the expert work in which they engage. These men are indispensable to these institutions, and it is for this reason that such duties must be permitted, but should be only under stringent restrictions. The teaching of foreign languages would better be directed to grammatical construction and translation, thereby inculcating in the student a lasting benefit, and one which may be personally enhanced with the aid of a dictionary. Those students who fail to gain any advantage from a technical course are, in most cases, those least fitted to pursue the same. A student's qualities, although not always shown by an examination paper, can generally be judged by the teacher having the interest of his course at heart, and it devolves upon him, without considering the consequent loss in tuition fees, to advise the delinquent to pursue some other vocation. The Society for the Promotion of Engineering Education has a splendid field to cover and opportunities to effect most valuable benefits.

PATENT OFFICE CRITICISMS.

It is of considerable interest to note the occasional adverse criticisms made upon the Patent Office and the patent system in general, not in a few cases warranted, and yet often by those who have derived from it the greatest benefits. Did some of these exponents realize the increasing jeopardy in which they are placing the system by inculcating in the minds of the rural representatives in Congress thoughts of abolishing the whole, they would perhaps express more guardedly opinions calculated to promote such revolutionary changes. With the gradually predominating tendency of the times to abolish all forms of monopolies and trusts, the more pronounced advocates of so-called governmental reforms look upon the patent system as one deserving to be placed in the same category. This condition has been brought about by the existing status of the patent laws and the opportunities which they offer for perverting the recognized merits in the patent system. One of the chief defects is that the Patent Office rules require that claims be amended or cancelled within six months of their rejection, while the law allows the patentee two years. It frequently happens that the date of granting a patent is postponed by interference suits and other causes difficult to explain, for a number of years, the life of the patent, however, extending for a period of 17 years from the date of its being granted. A case perhaps still more flagrant of this injustice than even the famous Berliner patent is that of a patent on typewriter machines, granted in April last, the application having been filed in December, 1881, nearly 15 years ago. This specification has no less than 104 claims, apparently embodying the fundamental features of typewriting machines, and if upheld in the courts, will have granted to the patentee or his assignors at the time of its expiration a practical monopoly for the period of 32 years. In order to avoid this abuse the life of a patent should begin, as in the British system, with the date of filing and extend perhaps for one or two years beyond the present limit. This change would doubtless obviate such charges of collusion as those made against the Patent Office in the Berliner case, charges which it is safe to say will never be substantiated, and at the same time limit the present unreasonable extensions so frequently met with. The enormous number of patents which are from week to week being granted fully demonstrates another weakness in the system. Ideas are embodied in the specifications which, if not worth the paper they are printed on, constitute merely minor details which enable the applicant to practice a routine system of blackmail on legitimate concerns. It is not infrequent that the latter, rather than be subjected to a threatened suit, will pay a royalty or other fee to the blackmailer. This abuse is strengthened by the fact that most people believe that a patent grants to the patentee the sole right to his invention for the period of 17 years, whereas in reality it merely extends to that person the privilege of bringing suit against the apparent infringer. This fact is in still stronger evidence in the English system, in which no examination is made by the office but simply by the attorney for the patentee, thereby leaving to the judgment of the latter the probability of original invention. The abuses and remedies in our own system are well recognized, but under present conditions any vigorous attempt made to correct them is likely to reduce the entire system to constitutional limits.

A New Standard of Light.

A French physicist, Broca, has found that the naphthaline light, otherwise known as the albo-carbon light, is an excellent secondary standard if the temperature of the reservoir is kept constant and the flame is kept quite close to the point at which smoking begins.

Convention of the Association of Edison Illuminating Companies.

The seventeenth convention of the above-named association was held at the Oriental Hotel, Manhattan Beach, Brooklyn, on Aug. 11, 12 and 13.

President C. L. Edgar called the meeting to order at 11 o'clock, Aug. 11, and the session was devoted to the reading of reports of committees on Welsbach light, storage battery, etc. At 1 o'clock an adjournment was taken until the afternoon.

At the second session, which was called to order at 2.30 p. m., a paper was read by Mr. C. E. Pattison, of Boston, on "The Storage Battery in Actual Operation in the Boston Edison Stations." The experience of the Boston Edison Company since the installation of its first storage battery several years ago was fully described and discussed.

The next paper was one by W. I. Donshea and H. A. Campbell, entitled, "The Storage Battery in New York Edison Stations."

The third session was called to order Aug. 12 at 10 o'clock, by President Edgar, and the first business was the reading of a paper by Alexander Dow on "The Selection of Alternating-Current Apparatus for Central-Lighting Stations." This paper was immediately followed by one of the same character by Mr. W. S. Barstow, of Brooklyn, entitled "The Alternating-Current System as a Pioneer." Both papers were discussed and many of the representatives of Edison companies gave their experiences with alternating systems used in combination with the Edison system.

At the fourth session, in the afternoon, Mr. R. S. Hale, of Boston, read a paper on "The Wright-Demand System of Charging for Current." An interesting discussion followed the reading of this paper as to the results met with in the system of discounts as outlined in a paper read at the last convention. The Chicago, New York, Cincinnati, Brooklyn and several other companies gave their experience in the new system of charging for incandescent light.

A paper was then read by John Wolff, of Brooklyn, on "A Self-Cooling Condenser in the Second District Brooklyn Edison Station."

The last paper of the convention was one by Mr. W. S. Andrews, of Schenectady, on "Some Recent Developments and Modifications of the Edison Underground System and the Use of Cables as Auxiliaries Thereto." An animated discussion as to the merits of the several underground systems and the use of different makes of cables followed the reading of this paper.

The very satisfactory financial condition of the association and the good work of the treasurer, as shown by the report, elicited much favorable comment.

The Committee on Nominations then made its report of the officers for the ensuing year, and they were elected as follows: President, Samuel Insull, Chicago; vice-president, R. R. Bowker, New York; secretary, W. S. Barstow, Brooklyn; treasurer, J. W. Lieb, Jr., New York. Executive Committee: C. L. Edgar, chairman; Alexander Dow, George R. Stetson, A. W. Field, J. H. Vail; ex-officio members, Samuel Insull, R. R. Bowker, W. S. Barstow and J. W. Lieb, Jr.

The visiting ladies were entertained by the Brooklyn Edison Company. The following is a list of those who attended the convention:

Thomas A. Edison, Llewellyn Park, Orange, N. J.; W. E. Gilmore, Edison Laboratory, Orange, N. J.

General Electric Company.—S. D. Greene, general manager lighting department; E. W. Rice, Jr., third vice-president; W. S. Andrews, manager central station sales; A. D. Page, manager lamp sales (incandescent lamp department); J. R. Lovejoy, manager supply department; J. W. Howell, engineer (lamp works); W. S. Clark, wire and cable department; John Kruesi, mechanical engineer; Caryl D. Haskins, motor department.

Illuminating Companies.—H. T. Edgar, Jas. G. Rossman, Atlanta, Ga.; C. L. Edgar, C. R. Pattison, R. S. Hale, Boston, Mass.; W. S. Barstow, W. F. Wells, John Wolff, Theo. Quillauneu, C. V. Driggs, Brooklyn, N. Y.; Samuel Insull, Joseph Insull, Luther Stieringer, Chicago, Ill.; A. L. Smith, Appleton, Wis.; E. A. Armstrong, J. J. Burleigh, Camden, N. J.; John I. Beggs, Cincinnati, O.; Samuel Scovil, Robert Lindsay, Cleveland, O.; A. W. Field, Columbus, O.; J. S. Crider, Cumberland, Md.; J. A. Colby, Des Moines, Ia.; Alexander Dow, Hoyt Post, Henry Ford, Detroit, Mich.; Christopher Wustenfeld, Elgin, Ill.; G. R. Stetson, C. R. Price, New Bedford, Mass.; R. R. Bowker, J. W. Lieb, Jr., W. I. Donshea, W. H. Lawrence, G. N. Moore, J. Van Vleck, Arthur Williams, E. A. Leslie, New York City; W. H. Johnson, J. H. Vail, Philadelphia, Pa.; G. A. Redman, Rochester, N. Y.; Reginald Van Trump, Wilmington, Del.; A. E. Kennelly.

American Association for the Advancement of Science; Forty-fifth Meeting.

BY WILLIAM H. HALE.

The forty-fifth meeting of the American Association for the Advancement of Science is noteworthy as being the fourth meeting to be held at Buffalo. Once in every decade, beginning in 1866, when the association was reorganized after the war, Buffalo is visited, while no more than two meetings have ever been held at any other one point. The great industrial development of Niagara will render the meeting one of great interest to physicists, engineers and economists.

The various affiliated societies will meet the week before and the week after the association, which will occupy the week beginning Aug. 24. It is a new experiment to hold continuous sessions running through the week without the intermission of Saturday and Sunday, and one which many members consider inexpedient. All former custom has been to meet on a Wednesday or Thursday, and occupy part of two weeks, giving up Saturday to the general excursion.

The first general session will be held at 10 o'clock Monday morning in the High School chapel. Prof. Edward W. Morley, of Cleveland, O., will call the meeting to order and introduce the president-elect, Prof. Edward D. Cope, of Philadelphia. Addresses are expected from Mayor Jewett, of Buffalo, president of the local committee, and from the retiring and incoming presidents.

On Monday afternoon the various vice-presidents will give their annual addresses to the nine sections. At 2.30 o'clock, Carl L. Mees will address the Section of Physics, on "Electrolysis, and Some Outstanding Problems in Molecular Dynamics"; Alice C. Fletcher, Section of Anthropology, on "Emblematic Use of the Tree in the Dakotan Group"; Benjamin K. Emerson, Section of Geology and Geography, on "Geological Myths." At 3.30 o'clock, William E. Story will address the Section of Mathematics and Astronomy, on "Intuitive Methods of Mathematics"; William R. Lazenby, Section of Social and Economic Science, on "Horticulture and Health"; Theodore N. Gill, Section of Zöology, on "Animals as Chronometers for Geology." At 4.30 o'clock, William A. Noyes will address the Section of Chemistry, on "The Achievements of Physical Chemistry"; N. L. Britton, the Section of Botany, on "Botanical Gardens"; and Frank O. Marvin, the Section of Mechanical Science and Engineering, on "The Artistic Element in Engineering."

Monday evening will be given up to the annual address by the retiring president, Prof. Morley, followed by a reception given by the Ladies' Reception Committee.

The remaining days of the session, Tuesday to Friday, will be occupied with reading of papers before the several sections. Some of the sections will interrupt the meetings by short excursions; on Thursday afternoon the geologists will be entertained by the Idlewood Club at the mouth of Eighteen-Mile Creek, a noted fossil collecting ground; on Friday, the botanists will be taken 10 miles up the Canadian shore to Point Abino.

EBEN P. DORR.

The evenings will be occupied with public lectures and receptions, including a reception by the Buffalo Club to the gentlemen of the association.

The general excursion on Saturday, Aug. 29, will be to Niagara, by boat to Chippewa, on the Canadian shore, where trolley cars will be taken for a picturesque journey to Queenston, at the foot of the escarpment. There the party will be taken across the river to Lewiston, N. Y., and transferred to Capt. Brinker's celebrated Gorge Railway. The return to Buffalo in the evening will probably be by boat from Schlosser.

The local arrangements for the meeting are in the hands of a large and influential local committee, of which Mayor Edgar B. Jewett is chairman. Most of the executive work falls naturally to the local secretary, Eben P. Dorr.

The Society of Natural Sciences has been efficient in organizing the local committee and in promoting arrangements for comfort and

convenience of the several scientific organizations which are to meet at Buffalo. The headquarters of the association for the meeting will be at the new and elegant Hotel Iroquois. Prof. F. W. Putnam remains, as for many years, permanent secretary of the association.

The preliminary announcement of papers to be read before the American Association for the Advancement of Science, in Section D (Mechanical Science and Engineering) justifies the expectation that the meeting will be the most important one to mechanical engineers ever held. The papers already entered are:

Steam Engineering.—The Most Economical Points of Cut-Off for Steam, by Henry T. Eddy. The Performance of Small Steam Pumps, by M. E. Cooley. The Friction of the Water in the Pipes of a Hot-Water Heating System, by J. H. Kinealy. On a Continuous Indicator for Engine Tests, by Thomas Gray. New Water Prony Brake for Testing Steam Turbines Without Reduction Gearing, by J. E. Denton. Apparatus for Tracing a Curve Representing the Force Required to Overcome the Inertia of the Reciprocating Parts of a Steam Engine, by D. S. Jacobus. An Apparatus for Accurately Measuring Pressures of 2000 Pounds and Over Per Square Inch, by D. S. Jacobus. Apparatus for Observing the Distribution of Moisture in a Steam Main, by D. S. Jacobus. Values of Heat of Combustion Per Cubic Foot of Various Gases, for Use in Calculating the Heating Power from the Analysis of a Gas, by D. S. Jacobus.

Mechanics and Materials.—Some Results of the United States Timber Tests, by J. B. Johnson. On the Molecular Stability of Metals, by Wm. A. Rogers. A New Testing Machine for Beams and Framed Structures (capacity, 50 tons), by Malverd A. Howe. On the Yield Point of Steel, by Thomas Gray. On the Conversion of an Ordinary Planer Into an Apparatus for Precise Graduations, by William A. Rogers.

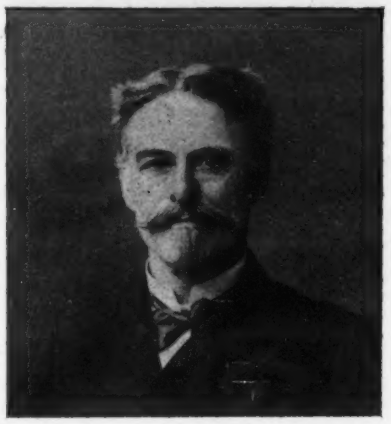
Hydraulic Engineering.—Irrigation for the Eastern United States, by Olin H. Landreth. The Hydrographic Survey, by F. H. Newell. Some Notes, Physical and Commercial, Upon the Delta of the Mississippi River, by Elmer L. Corthell. See page from Colorado Canals, by L. G. Carpenter.

Miscellaneous.—An Arrangement for Using Storage Batteries for the Automatic Regulation of Engine Loads in Power Plants of Variable Output, by W. S. Franklin. The Cycle of the Plunger Jig, by R. H. Richards. Soaring Flight, by Octave Chanute. National Endowment of Engineering Research, by W. S. Aldrich. The Better Distribution of Forecasts, by John A. Miller.

Physics.—Note on the Effect of Odd Harmonics Upon the Virtual Values of Periodically Varying Quantities, by Frederick Bedell. Electrical Waves in Long Parallel Wires, by A. D. Cole. Graphical Treatment of Alternating Currents in Branching Circuits, by Henry T. Eddy. On the Counter E. M. F. of the Electric Arc, by W. S. Franklin. Some Points in the Mechanical Conception of the Electromagnetic Field, by W. S. Franklin. Determination of the Specific Heat of Nitrogen by Adiabatic Expansion, by W. S. Franklin and L. B. Spinney. A Theory of Galvanic Polarization, by W. S. Franklin and L. B. Spinney. On the Rule for the Dynamo and Motor, by Alexander Macfarlane. On the Photographic Trace of the Curves Described by the Gryoscopic Pendulum, by Ernest Merritt. On the Distribution of High-Frequency Alternating Currents Throughout the Cross-Section of a Wire, by Ernest Merritt. An Experimental Study of the Charging and Discharging of Condensers, by F. E. Miller. On the Compactness of a Beam of Light, by Ernest R. Von Nardroff. On the Element of Diffraction in Fresnel's Experiments with two Mirrors and with the Biprism, by Ernest R. Von Nardroff. The Influence of a Static Charge of Electricity on the Surface Tension of Water, by Edward L. Nichols and John Anson Clark. A New Alternating-Current Curve-Tracer, by Edward B. Rosa. Preliminary Note on a Proposed New Standard of Light, by Clayton H. Sharp. Notes on Certain Physical Difficulties in the Construction of Modern Large Guns, by W. LeConte Stevens. On the Absorption of Light in Uniaxial Crystals, by Oscar M. Stewart. Note on the Duration of the X-Ray Discharge in Crookes Tubes, by Benjamin F. Thomas.

EDWARD D. COPE.

The president-elect, Edward Drinker Cope, was born at Philadelphia, July 28, 1840, and educated at the Westtown Academy and the University of Pennsylvania. He afterward studied comparative anatomy in the Academy of Sciences, Philadelphia, and the Smithsonian Institution, and later in Europe. He was Professor of Natural Sciences at Haverford College in 1864-7, and resigned at the latter year because of ill-health.



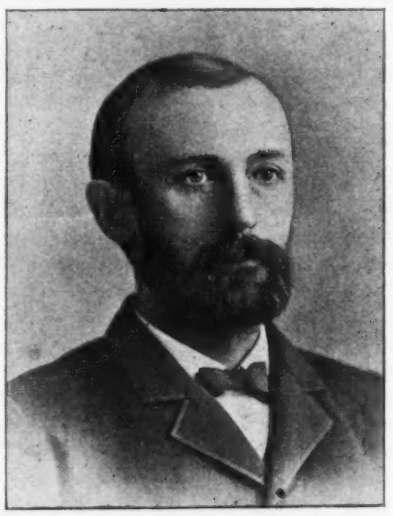
Edward D. Cope.

Later he was Palæontologist of the United States Geological Survey, serving first in the territories west of the 100th meridian. His discoveries were numerous and important, including nearly or quite 1000 extinct and as many recent vertebrates.

Prof. Cope was for many years secretary and curator of the Academy of Natural Sciences of Philadelphia, and chief of the department of organic material of the permanent exhibition of that city. He was elected a member of the National Academy of Sciences in 1872. He has published numerous works of a scientific nature, including several hundred papers, and dozens of longer works. He has for many years edited the *American Naturalist.*

MANSFIELD MERRIMAN.

Mansfield Merriman, president of the Society for the Promotion of Engineering Education, was born at Southington, Conn., March 27, 1848; was graduated in 1871 at the Sheffield Scientific School of Yale College, which also conferred upon him the degree of C. E. in 1872, and of Ph. D. in 1876. From 1872 till 1875 he was engaged in surveying and engineering work; from 1875 till 1878 he was instructor in the Sheffield Scientific School; from 1878 till 1881, Professor of Civil and Mechanical Engineering. Since 1881 he has been Professor of Civil Engineering at Lehigh University, Pa. During 1880-85 he was acting assistant United States Coast and Geodetic Survey, having charge of triangulation in Pennsylvania. In 1894 he was vice-president of the American Association for the Advancement of Science for the mechanical section, and read to the section the annual address on the Resistance of Materials Under Impact.



Mansfield Merriman.

He has published many articles in periodicals and the following books: Continuous Bridges; Elements of the Method of Least Squares; The Figure of the Earth, Text-book on the Method of Least Squares; The Mechanics of Materials; A Text-book on Roofs and Bridges; Treatise on Hydraulics; A Text-book on Retaining Walls and Masonry Dams, and Introduction to Geodetic Surveying. He has also prepared the chapter on the Solution of Equations, and in connection with Prof. Woodward has edited a text-book on Higher Mathematics just published.

American Chemical Society.

The thirteenth general meeting of the American Chemical Society will be held in Buffalo, N. Y., Friday and Saturday, Aug. 21 and 22, 1896, in the High School Building.

The opening session will begin at 9 a. m., Aug. 21. Dr. Roswell Park, president of the Buffalo Academy of Natural Sciences, will deliver an address of welcome, and the response will be given by the president of the American Chemical Society, Dr. Charles B. Dudley, of Altoona, Pa. The remainder of the morning session, and also the entire session on the morning of the following day, will be devoted to the transaction of business, the reading of papers, and discussions. In the afternoon of each day visits will be made to various chemical works in Buffalo and vicinity.

The Gebrueder Naglo Equipment of Telephone Exchanges—System Hess-Raverot-West.*

BY JUL. H. WEST.

AMONG the considerations which determine the value of a telephone system the two principal ones are, reliability and the quickness of the service. These two factors make it desirable to unite all subscribers of one city within one central station, and it is almost imperative in the long distance or interurban telephone service. All the subscribers of a long-distance telephone system should be able to communicate with one central exchange so that in the service of the long-distance lines the time for making the connections can be reduced to a minimum, thereby reaching the highest possible efficiency. Numerous telephone experts for these reasons have worked upon the problem of devising means which would permit of building central exchanges of any size which might be required by the increasing service. First it was tried to increase the number of possible connections in the multiple systems by making the plug sockets smaller for the purpose of getting more sockets on a board, the size of which is limited by the height of the operator. In this way it was possible to increase the number of connections to about 10,000 in stations of the multiple system.

This solution of the problem is to-day insufficient because there are already larger telephone systems, and is therefore to be regarded as only a partial remedy inasmuch as it endangers the reliability of the service.

The problem has been solved in a more effective way by others who tried to increase the number of the possible connections not in a mechanical way, but by the introduction of novel principles. To this class belong the systems of Siemens and Halske, of Engelmann, and a system similar to Engelmann's, which was applied in Albany under the name of the "Divided-Board System," and the "Express System," which was introduced in San Francisco more than a year ago. These constructions, which vary more or less from the multiple system, permit of connecting a larger number of subscribers with one station than the limit above mentioned, necessitating, however, the making of all connections in two places in the same way as if there were two stations in one town. They do not offer, therefore, with relation to the service in general, sufficient advantages to compensate for the saving in line material required for two stations, but may, however, answer very well under particular circumstances.

A happy and rational solution of this problem was brought about by G. A. Hess and P. E. Raverot, in Paris, who devised a new system of connections for central stations, on the principle of arithmetical combinations.

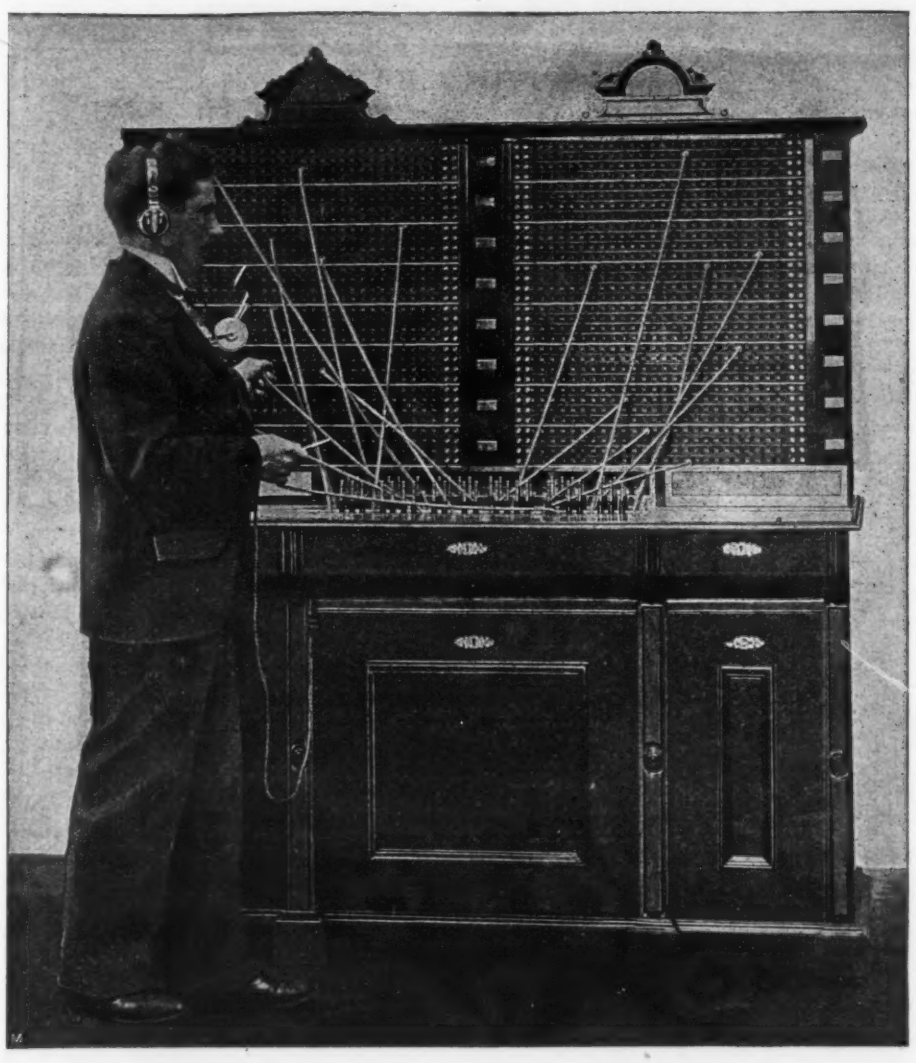


FIG. 1.

* From advance proof sheets of the *Electrotechnische Zeitschrift*, forwarded by the author.

In this system a connection is made and broken in one place only, whereby the desired improvement of simplifying the service in one station is arrived at.

The diagram of the Hess-Raverot combination system is shown in Fig. 2. According to the same the subscribers are divided into groups, which may for the present be designated by the letters of the alphabet. As will be shown further on, each group may comprise about 1000 subscribers. Each group is represented by a number of switch panels, with one hole or socket for each subscriber of the group. These switch panels are combined two by two with each other to "subscribers' boards." If there are, for instance, four groups *a*, *b*, *c*, *d*, and these boards are in one row, then the following combination for the series is obtained: *ab ac ad bc bd cd*.

Since the wires for group *a* are connected in multiple with the switchboard *a*, those of group *b* through the switchboard *b*, etc., the combination boards, as indicated in the above series, enable connecting directly with each other two subscribers. For instance, if *a* No. 406 wishes to talk to *c* No. 23, then the connection is made in the subscribers' board *ac* by means of one pair of flexible cords; if *a* No. 406 wishes to talk to *e* No. 904, then the connection is made on board *ae*.

From the subscribers' boards the circuit goes to the call board, where each is represented by one socket and one annunciator in such a way that the sockets and the annunciator drops of one group form one call board, which is divided in several working places for operators. One operator on the call board may therefore, when one call drops, connect with this subscriber, for instance, *a* No. 406, and take his order to connect him, for instance, with *c* No. 23. His duty is then to direct this order to that board, which only and alone can effect the desired connection; it is in this case the subscribers' board *ac*. The transfer of this order "*c* No. 23 with *a* No. 406" is made by telephone, and the operator on the board *ac* makes the desired connection in the usual way, and after the conversation is ended he disconnects them.

It is obvious that the number of groups may be increased to any extent without changing the service, and therefore this system permits with a rational and quick service to build exchanges of any desired size up to 50,000 subscribers and even more.

This system presented from the beginning such essential advantages that it appeared useful to me to assist in its introduction. On the above basis I have therefore in connection with the firm of Gebrueder Naglo worked out the system which is applied to a small model plant exhibited at the Berlin Industrial Exhibition of 1896. I shall now describe in the following my system in connection with this small experimental exchange:

If we consider the above given series of subscribers' boards as a continuous series of neighboring switch-panels

ab ac ad bc bd cd,

then it appears that each letter stands twice next to the other; for instance, there is at the beginning of the series *ab* and *ba* and then

follows *ac* and *ca*. The connection may therefore be made in two places, which is unnecessary. For this reason, and as already suggested by Hess and Raverot, several letters from the above given series may be omitted and then the following series will be obtained:

a b c a d b c d,

in which each letter is only once next to the other. For a station with five groups the following series will be obtained:

a b c a d b e c d e a.

Compared with the series for four groups this series has between the second *b* and the second *c* an *e*. This must be considered in advance because of future extensions and accordingly we get for four groups the following series :

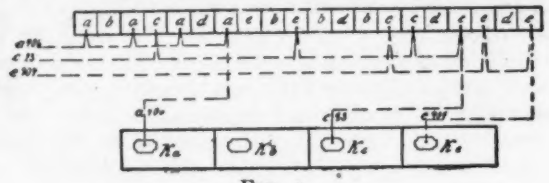


FIG. 2.

a b c a d b - c d,

where the switch-panel represented by the dash remains empty for the present being reserved to take up later on the sockets of the group *e*. For an exchange with 10 groups we get the diagram

a b c a d b e c d e a f b g c f d g e f g a h b i c h d i e
h f i g h i a k b - c k d - e k f - g k h - i k,

where for an eleventh group *l* space has been provided so that future extensions may be easily accomplished.

This succession of the panels makes it necessary that all the circuits of the subscribers are conducted along the whole series of panel rows and in this respect the highest limit is soon reached, when this arrangement is no longer applicable, because the length and the number of the cables running through the panels will be too large. Where this limit has been reached the diagram given below

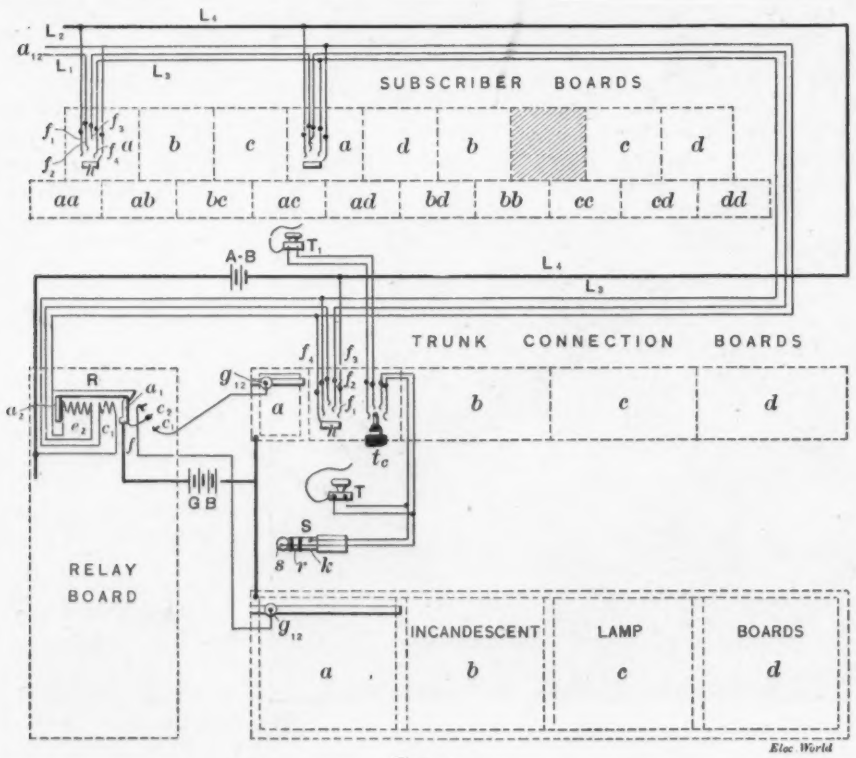


FIG. 3.

offers a suitable distribution of the cables. The original diagram for large stations of Hess-Raverot was the following :

ab ac	*ad ae af ag*
bc	*bd be bf bg*
	cd ce cf cg
	de df dg
	ef eg
	fg

in which the *a* cables run through the upper vertical row of the connection panels, while, for instance, the *c* cables, as indicated by the line, run through the second panel of the first row, then through the first panel of the second row and then through the third panel. With this arrangement there is, however, the disadvantage above mentioned, that all operating places have to be provided for twice. This disadvantage is therefore easily removed, if in one of the horizontal rows not one but two letters are combined with the others according to the following diagram:

a b c a d b e a f b g a
c d e c f d g c
e f g e

For 20 groups, *a* to *u*, the following diagram is deduced, which explains the simple distribution of the cables:

a a b c a d b e a f b g a h b i	*a k b l a m b n a o b p a q b r a s b t a u b b*
c c d e c f d g c h d i	*c k d l c m d n c o d p c q d r c s d t c u d d*
e e f g e h f i	*e k f l e m f n e o f p e q f r e s f t e u f f*
g g h i	*g k h l g m h n g o h p g q h r g s h t g u h h*
	i k l i m k n i o k p i q k r i s k t i u k k
	l l m n l o m p l q m r l s m t l u m m
	n n o p n q o r n s o t n u o o
	p p q r p s q t p u q q
	r r s t r u s s
	t t u u

The general plan for a station with four groups is shown in Fig. 3. The equipment consists of the subscribers' boards in which the connections are made, the call panels in which the calls are received, the relay cases which contain the call drops, constructed like relays, and an incandescent lamp board which indicates in a visible way whether or not the lines or circuits are engaged or not. The double circuit of a subscriber of group *a* runs first through the two *a* switch-panels on the row of the subscribers' boards, because, as the graphic plan or diagram shows the sockets for leading-to are in series while for the return they are in multiple arc. From the subscribers' boards the circuit runs to the call panel of a certain group (*a*), where it is connected with a like socket ; from here it runs further to the call relay *R* in the relay case which is shaped similar to the well-known self-acting drop of the Western Electric Company. The front armature *a* of this relay can occupy three positions ; it may be at rest as shown in Fig. 3, or it may have dropped, and then the spring *f* presses against the lower contact c_1, and the rising position by which *f* presses against c_2. When in the lower position *f* closes the circuit of one incandescent lamp, g_{12}, which is located on the call panel. In the upper position, on the contrary, an incandescent lamp of the same number (g_{12}) in the lamp board is lighted, which shows for the whole station, as mentioned, in a visible way whether the subscribers' circuits are free or engaged. Besides the two circuits, L_1, L_2 of the subscribers, a third circuit, L_3, is provided, which starts from the spool e_1 of the call relay, and branches off to the contact spring f_4 (compare also Fig. 5) of all the sockets of the respective circuits of the subscribers. Another circuit, L_4, which is common for all sockets of the whole exchange, branches off on one side to spring f_1 of the sockets, and on the other side of the battery *AB* to the individual relays.

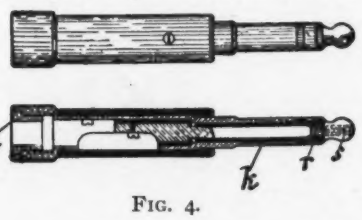


FIG. 4.

The operation is as follows :

When the subscriber (*a* No. 12) sends the call current then the electromagnet e_2 attracts its armature a_2 whereby the front armature a_1 is released and drops forward so that the circuit of the lamp g_{12} in the call panel is closed. The burning of this lamp serves the operator as the call sign, who then will put the three divided plug *S*, connected with his telephone *T*, into the socket or hole of the same number g_{12} whereby he puts himself in direct connection with the subscriber ; the part *k* touches the shell *h*, and a point *s* touching the spring f_2 thereby lifting off the spring f_3. By the separation of f_2 from f_3 the call electromagnet e_2 of the relay is taken out of the talking circuit at the same time the local circuit is closed by the electromagnet e_1, the isolated ring *r* of the plug *S* connecting the springs f_1 and f_4 of the socket with each other ; consequently e_1 at-

tracts its armature a_1 whereby the circuit of the lamp g_{12} in the call panel is interrupted and the circuit of the lamp of same number (g_{12}) in the lamp board is closed. The latter designated lamp burns now as long as this or any other socket of the respective circuit is plugged and correspondingly indicates that the line *a* No. 12 is engaged.

After connecting by means of the plug the operator calls "Hier Amt" and the subscriber tells him the number of the person he wishes to talk to, for instance, *c* No. 209. The operator then looks over his panel to the lamp board in order to convince himself whether the desired line is free or not; if it is free then lamp No. 209 in the field *c* does not burn.

If this wire is not free then the operator replies that wire *c* No. 209 is engaged and draws his plug from the socket, whereby the local circuit of the electromagnet e_1 is interrupted so that it releases its armature a_1, the armature turns forward until it is arrested by the drop lever in the position shown in the diagram, when the lamp g_{12} of the lamp board will become extinguished.

When the desired wire is free then the operator on the call frame communicates with that operator who alone can make the desired connection. For this purpose there are on each operator's panel a number of keys by means of which the operator connects himself by telephone with the operators who can make connections from his group (*a*) with the other groups; there are

aa, ab, ac, ad;

the keys pertaining thereto are designated by the letters

a, b, c, d.

In the case above described the operator will touch key *c* — in the figure shown as t_c — and gives without delay the order; connect *c* No. 209 with *a* No. 12, when the addressed operator will at once connect the two subscribers by means of a pair of flexible plug cords. The respective relays are hereby taken out of the talking circuit as before and the lamp of the lamp board pertaining thereto lighted. After receiving the closing signal the connection is interrupted when the lamps at once extinguish.

It is evident that it is desirable to make the groups as large as possible, for the larger the groups the smaller will be their number, and correspondingly will be the number of the necessary socket fields. The number of the subscribers in one group, however, must be so selected that one operator is able to make all connections between two groups. The size of the groups is therefore determined by: First, the number of the simultaneous connections at the busiest time of the day, and, second, the number of connections which one operator can make through the average duration of a conversation. The first of these numbers can hardly be effected by the construction of the equipment. The second number is to a large degree dependent on the construction and the working of the system, which circumstance requires that the handling of the connecting flexible plug cords must be as plain and quick as possible. The present system answers this requirement by the employment of automatic devices, some of which act at the right moment with each connection without special attention on the part of the operator, so that the actual work of the operator is limited to putting in and taking out the plugs of the sockets. With such a plain arrangement one operator may easily attend to 30 pairs of plug cords. Starting from this number the size of the groups will be derived in the following manner: Grant that the station has ten thousand (10,000) subscribers, then there are necessary in the busy districts 1300 plug cords, with reserves counted in, in order to satisfy the demand during the most busy hours. If we now, according to the present system, divide the 10,000 subscribers, for a trial, in 10 groups, with 1000 subscribers each, then we receive, according to the above arrangement of the subscribers' boards, 44 working places which are fitted up each with 30 pairs of plug cords, making together 1320 pairs. This number is sufficient to manage the demand so that in fact each group may comprise 1000 subscribers. Certainly this number will vary with the local commercial circumstances. In general the number may, in all probability, vary between 700 and 2000, in such a way that the groups may be larger when the telephone system is larger. The increase of the business does not keep in step with the extension of the system, but remains always a little behind.

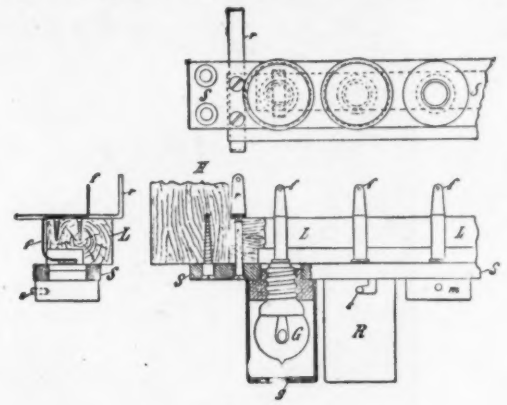


FIG. 6.

The present experimental exchange contains in each group 800 subscribers. Fig. 1 shows the first switchboard and the first working place *ab*, with the table for 30 pairs of plugs, and behind these the socket panels *a* and *b*, with 800 sockets each. The dimension of the switchboard is such that the neighboring operators may move freely and still have the necessary space for working, which is 65 centimetres in width. With this width and the small number of sockets in one board, it follows that the single sockets are pretty far away from each other, which is in a certain sense of considerable advantage. The single rows of sockets, each of which contains 25, are separated by thin, yellow wood strips, and the groups of 100 are separated by larger white strips, thus facilitating a quick inspection of the board. The construction of a strip for sockets is shown in Fig. 5. The springs f_2 and f_3 of the contact are vertically mounted, and are provided with platinum points. The contact is a sliding one, giving way spring-like when coming in contact with f_3. In this

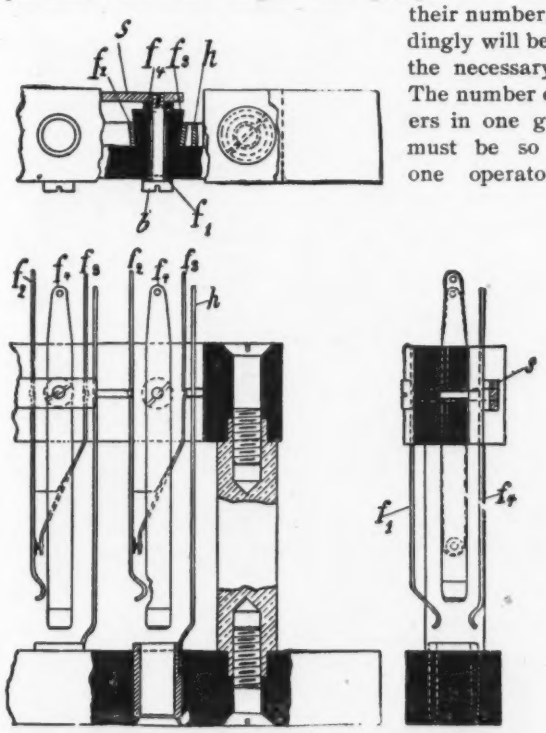


FIG. 5.

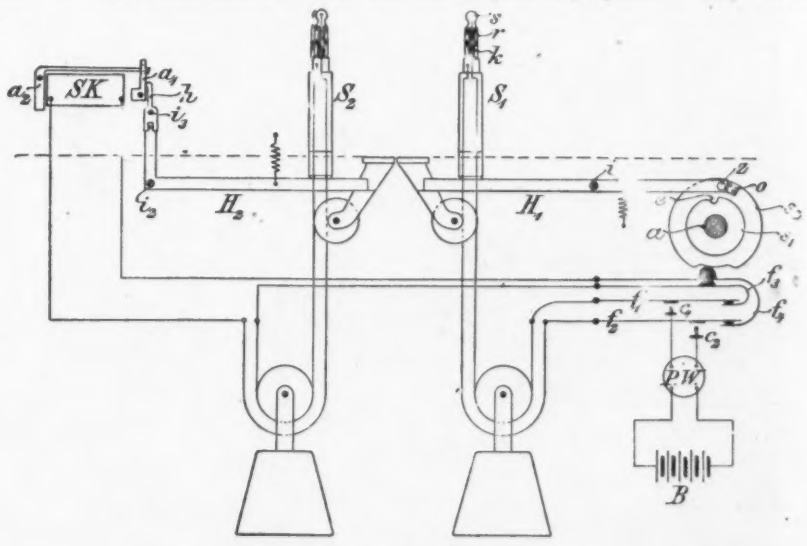


FIG. 7.

way contact disturbances are practically impossible. The splint s corresponds to the circuit L_4 in Fig. 3.

The construction of the plug is plainly seen in Fig. 4.

The above-mentioned devices consist in a simple lever mechanism for automatically raising the closing drop, and of a switch which, when the plug is inserted, commences to operate and sends a call current into the same for about four seconds. These two devices are represented in diagram in Fig. 7. The front plug S_1 rests upon a movable double lever, H_1, which turns on the axis i_1. Lever H_1 has on its front end a point extending from both sides. The axis a is rotated slowly by a small motor, making one revolution in about five seconds.

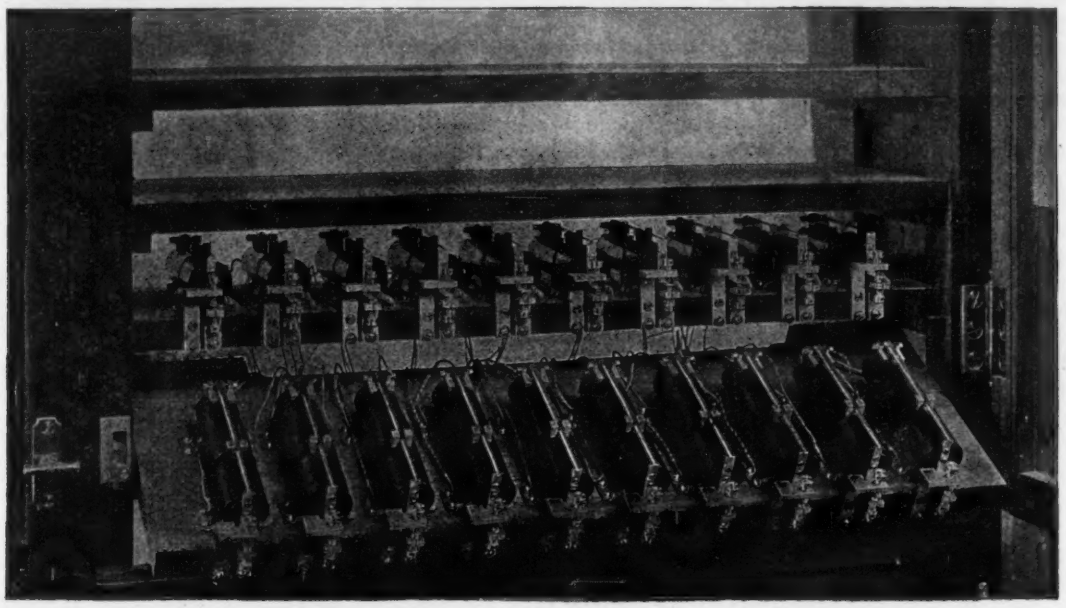


Fig. 8.

On this axis are provided the two permanently connected discs, s_1 s_2, which press gently on the axis, and therefore have the tendency to turn with the axis. As long as H_1 occupies the position shown, this motion is prevented by the projection o, which presses against the extension z. When the plug S_1 is raised then the lever H_1 turns in such a way that z moves downward until it presses against the disc s_1, thus freeing the knob o, and both s_1 and s_2 follow now the motion of the axis a, whereby the contact-springs f_3 and f_4 are soon pressed downward so that f_1 and f_2 touch the battery-contacts, c_1 and c_2, while the contact between f_1 and f_3, as well as between f_2 and f_4, is interrupted. In accordance with this call, current is sent from the battery, B, over the commutator, PW, into that line in whose socket the plug S_1 has meanwhile been inserted. As mentioned this lasts for about four seconds, until the discs have turned so far that the isolating piece between f_2 and s_2 fall again in the groove of s_2, whereby the indicated contacts are again made. One moment later the notch e reaches the point z, so that z enters the notch e, whereby s_1 and s_2 are arrested. After concluding the conversation the plug S_1 again falls on the lever H_1 and turns into the position shown, so that the discs s_1 and s_2 are again set free and turn a little further until o presses against z.

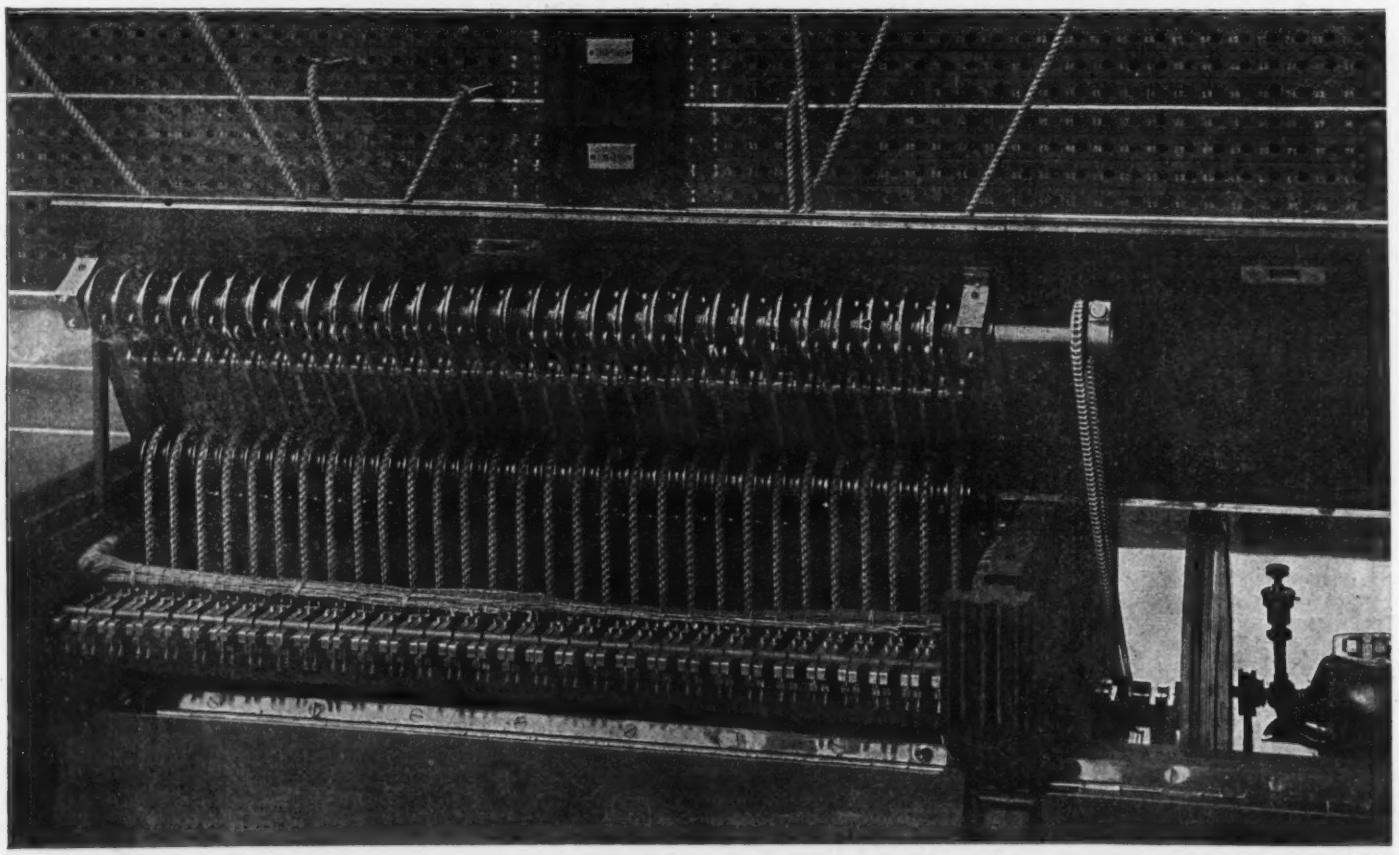


Fig. 9.

The construction of the equipment as explained, is represented in Fig. 9, which shows the connecting frame with the plug table turned

up. A small continuous-current motor is shown on the right side, which turns slowly the axis of the described switching mechanism by means of a double string and a single chain transmission. This axis carries the discs pertaining to the 30 pairs of plug cords and rests in two blocks, which are like the blocks of the 30 connection levers, fastened to a metal plate screwed to the lower side of the plug table. Instead of acting by friction, as stated in the explanation of the diagram, these discs are coupled to the axis by a plain tooth wheel coupling under the influence of the motion of the switch-lever. In front of the suspended cords, shown in Fig. 6, are the contact positions f_1, f_2, f_3, f_4, c_1 and c_2 and their leading-to wires. In order to insure a smooth and undisturbed falling down of the moving weights, partitions of iron sheeting are provided between the single pairs of cord. The raising device of the drop SK, Fig. 7, consists of a lever H_2, movable on the axis i_2, and of a small double-armed lever h, which turns on i_3. If S_2 is lifted, then the right end of H_2 turns upward, and with it the upper end of h turns to the right. When the final signal is given then a_2 is released and turns forward until it rests against the small lever h. If now s_2 is taken out of the socket then it falls on H_2 and turns the same and with it h and a_2 in the position shown in the diagram.

The drops are located in the case in one row below the socket panels and behind a strong glass plate provided with an elongated metal frame, so that they are protected against damage.

The call case, Fig. 10, is fitted up with working places each for 200 subscribers; each working place contains also a lamp bank of 200 lamps, and below a socket bank with 200 sockets. There are further at the left of each socket bank three "call keys" for the lines connecting with the three working places *ab*, *ac* and *ad* of the subscribers' boards.

As is shown, the lamps are arranged so that 20 are in one row, each row being covered by a brass tube whose front end is closed by a dark green glass pane. The back of this glass pane is covered with a thick dull white color in which a number is cut in. Behind the glass pane is a sheet of dull white parchment paper. With this arrangement the number is not visible when the pane is lighted only from the front side; it appears, however, green on a dark background when the lamp burns, because the thick color which surrounds the number does not permit the light to pass through.

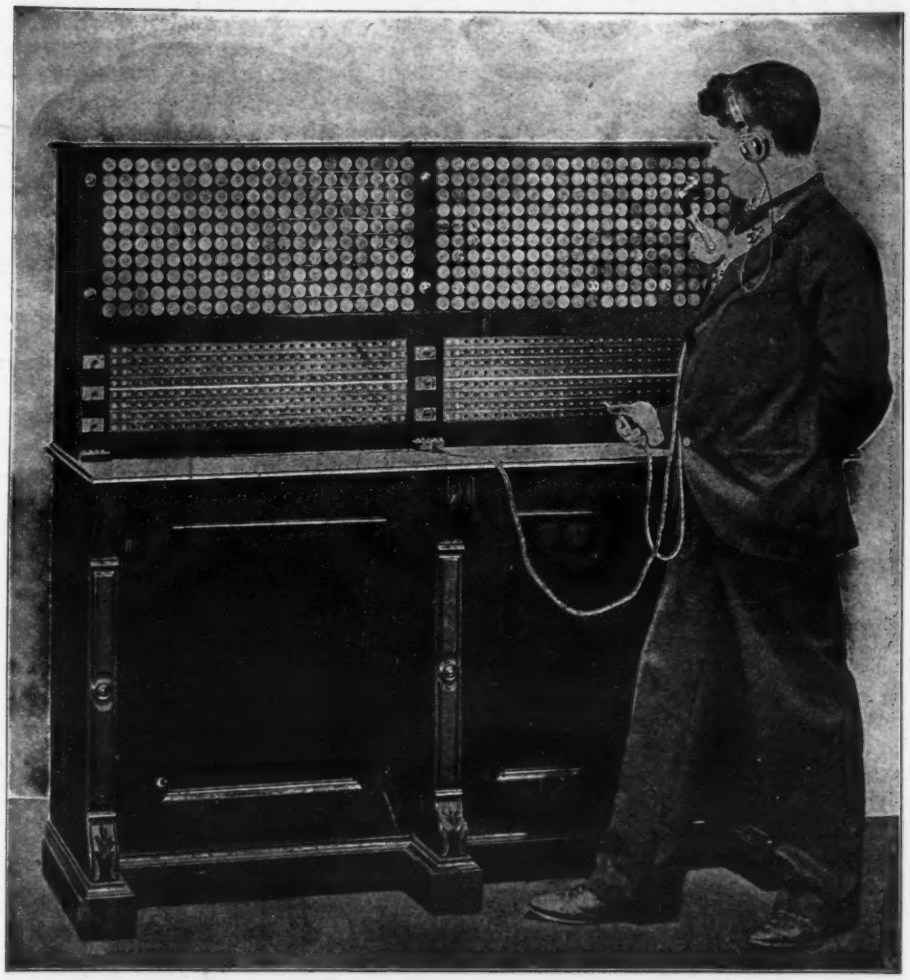


FIG. 10.

The 20 lamps of one row are fastened upon one common iron conductor, S, Fig. 6, and connected with the one pole of the battery. In the connecting conductor an "indicator lamp" is connected by means of a relay. This lamp always lights up if only one of 200 subscribers' lamps burns. The operator does not need to watch the whole lamp bank, but needs only to watch this one lamp because it indicates that a subscriber wants connection. This offers a special facility during those hours of the day when little business is done, and during the night, when one operator has to attend to several working places. Behind the iron rail is a wooden strip, L, which carries the contact springs, f, for the middle pole of the lamp. The tube, R, is shifted into the metal base, m, of the lamp, so that any defective lamp can easily be replaced. The tube can be touched without danger because only four-volt lamps are used. The speaking apparatus for the operator as shown in Figs. 1 and 10, and the head telephone and the breast microphone of Ericsson & Co., Stockholm, are used. The latter permits of free motion on the part of the operator.

The lamp board is divided into banks of 100 lamps each. Of the eight banks only four are filled with lamps. For distinction three banks are provided with white numbered glasses and one bank with green. The green color seems, however, to be more practical than the white. The arrangement of the lamps is the same as in the call-case.

All the relays of one group are stowed away in a double relay case with glass doors so that they are protected from dust. The relays are mounted as shown in Fig. 8, 10 on one board, which can be taken out of the case. Adjusting and cleaning of the contacts can conveniently be done from the front. The connecting wires shown in the diagram are temporary only and will be replaced by spring contacts so that the boards may be changed within a few seconds. The rear contact springs are fastened on the front side of the back wall while the conducting cables are provided along the back of the same. The duties of the attendant consist of the following operations:

(a). When the desired wire is used.

In the call panel *a*.

1. First manipulation: Insert the plug into the socket of the calling subscriber 12.

2. Reply: "Hier Amt"—Take the required number *b* 15—look at the lamp to see whether wire *b* 15 is free—reply wire *b* 15 is engaged.

3. Second manipulation: Withdraw plug from socket 12.

(b) When the required wire is free.

In call panel *a*.

1. First manipulation: Insert the plug for the calling subscriber 12.

Second: Reply. Exchange here. Take the required number *b* 15; look at the lamp board to see whether wire *b* 15 is free.

Third: Second manipulation. Press down the call key *b* and report to the connecting operator *ab*; connect *b* 15 with *a* 12.

Fourth: Third manipulation. Remove the plug from socket 12.

In subscribers' panel *ab*.

Fifth: Fourth manipulation. Insert the plug in socket *b* 15.

Sixth: Fifth manipulation. Insert the plug in socket *a* 12.

Seventh: Sixth manipulation. Remove the plug from socket *a* 12.

Eighth: Seventh manipulation. Remove the plug from socket *b* 15.

The manipulations of the operator on the call panel, A_2 of a call, and A_1 of the following requires during rushing business only one grip of the hand, similarly for B_4 and B_1; therefore, the service in the station when the wire is free consists of six operations for the connection and disconnection of a subscriber. It consists of one manipulation only when the required wire is engaged.

There is a control for every single device for the purpose of securing proper execution. When a wrong socket has been plugged at A_1 and B_1 then the burning incandescent lamp does not extinguish, thus calling the attention of the official to his mistake so that

no time is lost by talking into the disconnected wire. During the manipulation B_3 the subscriber is connected and hears the report of his order so that he can ascertain for himself whether he is connected with the right number or not, and if necessary he may prevent his being connected to a wrong party by calling the operator's attention to his mistake, at the same time repeating his order; these reports are heard by both officials. Further, the official on the call frame can ascertain whether the connecting operator has properly executed the given order to connect b_{13} with a_{13}, for in this case b_{13} will appear first on the lamp board, and the lamp a_{13} on the other when burning already should not extinguish when he removes the plug from the socket a_{13}.

The groups have been designated by the letters of the alphabet. As, however, consonants like b, p, w, m, n, d, t, c, etc., are hardly distinguishable in the telephone it is necessary to replace these letters by short, striking names which commence with the respective consonants.

i a k b l a m b n a o b p a q b r a s b t a u b b
i c k d l c m d n c o d p c q d r c s d t c u d d
i e k f l e m f n e o f p e q f r e s f t e u f f
i g k h l g m h n g o h p g q h r g s h t g u h h
i i k l 1 m k n i o k p 1 q k r i s k t i u k k
l l m n l o m p l q m r l s m t l u m m
i h g g n n o p n q o r n s o t n u o o
i f h e g f e e p p q r p s q t p u q q
i d h c g d f c e d c c r r s t r u s s
i b h a g b f a e b d a c b a a t t u u

With reference to the location of the boards and cases it is plain that only the lamp boards and the operator's boards are placed in the same room, while the other parts of the outfit may be placed into other rooms. It is preferable for larger stations to have one room for the operator's boards, the lamp boards and the relay cases, and another room for the subscribers' boards.

In a station for 40,000 subscribers the operator's boards require a six-cornered room of about 18 metres diameter. The operator's boards are set up in four rows, which run parallel with the walls. The rows are arranged so that those nearer to the middle of the hall are always half a metre higher than the previous ones, so that the operators can conveniently inspect them all.

The six walls are covered by four complete lamp boards in such a way that each board with 40,000 lamps occupies one half of the wall. There are accordingly four incandescent lamps to indicate the wires being used. With this arrangement the largest distance which one operator has to go to the lamp furthest away is nine metres, a distance at which the signals are perfectly recognizable.

In the arrangement described for subscribers' boards, for 20 groups there will be 211 working places of 30 pairs of plug cords each, which gives altogether 6330 pairs of cords, a number which is sufficient, even allowing for an increase in business, for about 40,000 subscribers. This number divided in 20 groups gives about 2000 subscribers per group.

The subscribers' boards indicated in the diagram on page 218, second column, require a hall of about 18 by 20 metres, if that part at the left of the vertical line is taken off and arranged in such a way as is shown in the diagram on this page, so that it fills the empty space below on the left part of this diagram. Besides these rooms only little room is necessary, excepting for the accumulators. The relay cases may be placed along the walls in the operators' room below the lamps.

The small amount of space required with this system makes it commendable as compared with the space required by exchanges with the multiple system. As to the cost of the equipment it may be mentioned that the fitting up of one exchange for 40,000 subscribers is cheaper than seven exchanges on the multiple system, having five for every 6000 subscribers, and two for every 5000. The number of sockets will be hardly 500,000 in the large exchange, while in the seven small exchanges, it will be about 2,500,000. The number of operators necessary at the same time is 411 at the highest in the system as against 1000 to 1200 with the multiple system when the plan of the working places as introduced in Berlin is adopted, that is 66 to 67 subscribers with 10 to 12 subscribers' lines per working place.

Municipal and Opposition Plants.

The chairman of the committee appointed to act for the Northwestern Electrical Association in regard to the establishment of municipal and opposition plants requests that any facts or figures possessed or obtainable by those in sympathy with this movement be sent to Mr. Henry L. Doherty, Madison, Wis.

Use of Photography in Data Collections.

BY REGINALD A. FESSENDEN.

One of Conan Doyle's characters, on being remonstrated with because, possessed of much curious and detailed information, he was yet ignorant of certain "common-school" facts, replied that a man's head would only hold so much and that he had no room for anything not connected with his business. Without touching upon the fallacy of the idea (unfortunately too prevalent), that knowledge not immediately related to one's profession does not pay commercially, we must acknowledge the fact that one's mutual capacity for facts is not capable of indefinite extension. With increasing interests and fast multiplying methods of gaining knowledge the engineer sooner or later comes to the point when he can no longer rely upon his memory for the collection and preservation of his technical and scientific data.

The history of the writer's attempt to *barrage* the flood of facts is no doubt typical. First the scrap book appeared and multiplied exceedingly. Then came a series of note books with lettered subdivisions and subscriptions to numerous indexes and year-books. These helped matters, but it was not until the card catalogue stage was reached that the writer found a satisfactory solution.

For the benefit of those who may not have used it, I may say that this system is as follows: Small cards are used (about 5 x 3 inches) made of paper about as thick as a postal card. These are furnished at a very cheap rate by any of the card catalogue companies. The writer obtained his from the Library Bureau Company, Philadelphia. About a dozen of these are readily carried in the pocket-book along with a stylographic pen. On coming across an article of interest an entry is made, of which the following may be taken as a sample:

Cotton Mill Plant. H. E. Raymond. The Electrical World, July 4, 1896; Three-phase. Combined mill and street railway plant. Regulation satisfactory. Water power, Lombard governor. 24-cp ground glass lamps found best in mill. Descript. of plant and governor. Water, Turbines and Corliss engine run in parallel.

These cards are then deposited in the index boxes under the proper heading. Each box is about 6 x 4 x 15 inches. A couple of boxes will be sufficient for all but the most indefatigable note collector, especially if he subscribes to several regular indexes. The headings I have found most convenient are: Advertisements, Addresses, Books, Light, Electric Light, Gas Light, Light Absorption, Light Instruments, Light Measurements, Photography, Light

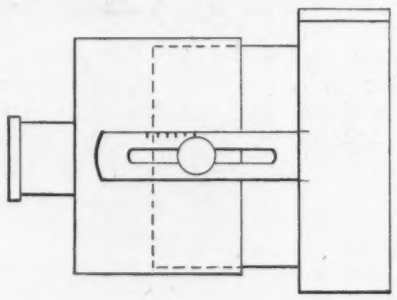


Fig. 1.

Theory, Heat, Specific Heats, Boiling Points, Melting Points, Critical Temperatures, Heat Expansion, Heat, Thermometry; Heat, Mechan. Equivalent; Heat Theory, Chemical Analysis, Atomic Weights, Chem. Technology, Chem. Preparations, Chemical Theory, Pure Mathematics, Math. Methods, Mathematical Physics, General Physics, Physical Apparatus, Molecular Physics, Metals, Metallurgy, Gravity, Electro-Metallurgy, Alternating Currents, Electrolysis, Elect. Capacity, Elect. Resistance, Elect. Instruments, Elect. Standardizing, Elect. Testing, Thermo. Electricity, Theoretical Elect., Magnetism, Elect. Laboratories, Dynamos and Motors, Armature Windings, Transformers, Street Cars, Electric Lines and Construction, Storage Cells, Central Stations, Power, Power Transmission, Steam Engines, Gas Engines, Boilers and Stokers, etc.; Steam Engine Theory, Belting, Friction, Paints, Compounds, etc.; Mechanism, Machinery, Price of Apparatus, Cost of Power, Cost of Work and Material, Prices of Steam Apparatus, Price of Electrical Apparatus, Depreciation Figures, Cost of Lighting, Statistics of Power and Light Stations, General Economic Statistics.

The above list has proved fairly satisfactory to the writer, but no doubt each engineer will have a different idea as to the best arrangement.

I have said that the card index offered a satisfactory solution of the problem. So far as it goes, after a three years' trial, I am satisfied that it is the best method that can be devised if the notes are to be made by hand. The cards are easily carried, always at hand, and the index is capable of indefinite extension.

Many times, however, I wished to copy down much more matter than would go on one or two cards. This is very tedious work, as not many men will ordinarily write more than 20 to 40 words per minute when copying an article from a scientific book. Two thousand words then would take one or two hours to copy out, and occupy considerable space when done. Moreover, if tables and curves had to be copied the time would be extended and there is always the possibility of making mistakes.

After considerable experimenting I at last hit upon a method by which it is quite easy to copy 2000 words, including figures and curves, in something less than a minute, and at very little trouble. In fact the actual copying takes but 20 seconds, the remainder of the minute being taken up by operations which can be done at any convenient time.

This method has now been used by me for a year, and as it has proven perfectly satisfactory in practice I have thought that a description of it might be of interest to others.

The method is a photographic one. This means has of course been used often before, but never, so far as I know, satisfactorily as a regular system. The difficulties have been found in the necessity of accurate focusing, in the expense of the plates and in the time taken in putting the object in a suitable condition to be photographed. These difficulties I have overcome.

The camera is shown in section in Fig. 1. It is 1¼ inches focus and has a lens of ¼ inch aperture. It is thus about 25 times as rapid as the ordinary photographic lens with the usual stop, and takes in a very wide angle. It was made for me by Messrs. Bausch & Lomb. For all objects over two feet away it needs no focusing, and is often useful as a view camera, as the pictures taken will bear enlarging to 4 x 5 size, and make quite good lantern slides. For use in copying data, however, the sliding straps *a a* are nicked so as to indicate when the camera is properly focused for 6, 7, 8, 10, 12 and

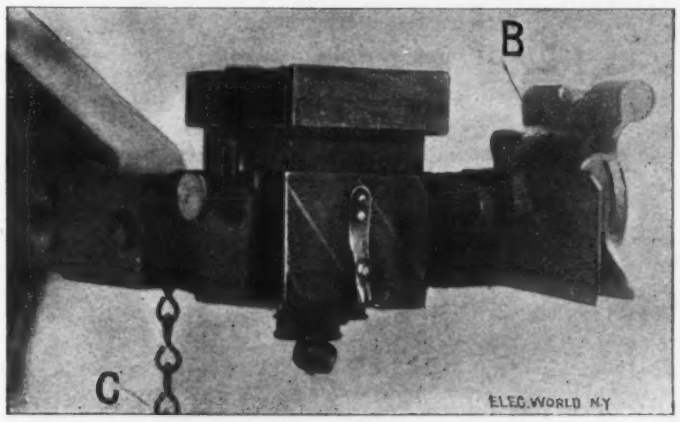


FIG. 2.

18 inches. The method of mounting is shown in Fig. 2, and is a geometric clamp of a very simple kind. *B* is a level. *C* is a chain, and the links at 6, 7, 8, etc., inches from the lens have marks on them.

The general plan of the mounting is shown in Fig. 3, where the apparatus is being used to copy a letter. The method of use is as follows: Suppose it be desired to copy a table which occupies a quarter of a page of THE ELECTRICAL WORLD. A quarter page is about five inches on its long side, and this will be taken in when the lens is seven inches from the paper. The paper is laid down on the desk so that the chain comes near the centre of the table we wish to copy, and the camera pulled down till the seven inch mark on the chain touches the paper. A plate-holder is then put in the camera and exposed for 10 seconds, if the illumination comes from a student's lamp of 32 candle-power placed on the desk beside the paper. The plate-holder is then put away till a convenient opportunity occurs for developing. From the time it is decided to copy an article till the operation is finished need not take more than twenty seconds.

It is not necessary that the paper be perfectly flat, as on account of the short focus of the lens a difference of a quarter inch or so makes no difference so far as definition goes. It is advisable to have it fairly flat, however, if only one source of illumination is used, as otherwise part of the paper may be in shadow and will be fainter than the rest. In daytime the exposure is about $\frac{1}{10}$ second or less. It is always advisable to under expose, as better contrast is obtained. These times are given for Seed 27 plates.

When 25 or 30 plates have been exposed, which may be once a week or so, they are all put in one tray and developed together. As all have had the same exposure it is not necessary to watch them carefully, and in practice the writer generally puts them in the developer and leaves them, returning after five minutes to put them in the fixer. After leaving them five minutes in this, they are put in pure water for a time—generally an hour—and then taken out and stood on edge to dry, when they are ready to file away. The time actually spent in developing 25 plates is something less than five minutes. Thus the whole time spent in copying one article or table, including preparation for photographing, exposing, developing, fixing, washing, filing away and labeling is less than one minute.

The negatives are filed away in small envelopes stuck to the backs of the data cards, as shown in Fig. 4.

FIG. 3.

Each plate is 1¼ x 1½ inches, and can take upon it 2000 words, or one full page of THE ELECTRICAL WORLD, so that each word can be easily read with a small magnifying glass. Of course, full-page drawings are shown with equal distinctness.

In most cases, however, one does not wish to copy more than 400 or 500 words, and this number of words can be read with ease by any person of average eyesight, without the use of a glass. I have found Rowland's developer the best so far. Its formula is :

Solution A.		Solution B.	
Hydroquinone,	4 gms.		
Sodium Sulphite,	20 gms.	Potassium Carbonate,	16 gms.
Water,	100 c. c.	Water,	100 c. c.
Alcohol,	2 c. c.		
Solution C.		**Solution D.**	
Potassium Ferrocyanide,	16 gms.	Bromide of Potassium,	1 gm.
Water,	100 c. c.	Water,	100 c. c.
Solution E.			
Hyposulphite of Sodium,	4 gms.	Sulphite of Sodium,	4 gms.
Water,	100 c. c.		

For developer, take 75 c. c. of A, 12½ each of B and C, and 10 drops of D.

Solution E is the fixer. Development should be made at a temperature of about 75 degrees Fahr. to get best results.

Of course, if desired, positives or lantern slides may be made from the plates. For general use, however, the negatives are as good.

From what has been said above it will be seen that the photographic method of copying, including all operations, takes only about 1 per cent. of the time that writing down would. It is also far more convenient, for on coming across a table one wishes to copy, the interruption is of only, say, twenty seconds, and there is much less annoyance about the operation. There is also very great economy of space and less liability of error. It remains to speak of the cost.

Each small plate costs approximately one-third of a cent. Adding cost of chemicals, the total cost per fixed negative is about one-half of a cent. It thus costs less than the paper on which the data would otherwise be written, leaving out of consideration the saving of time, which is of course by far the more important point. The saving is so great that the writer now uses this method for copying his private correspondence, as it is quicker, cheaper, more convenient, and does not spoil the appearance of the letter.

Before leaving the subject I may say that I have found, by experience, that a small camera, taking 3¼ x 4¼ plates, is by far the best suited to the purposes of the engineer. This is for the following reason: With a larger camera, say a 6½ x 8½ one, the variation of the focus of an object outside of the plane on which the lens is focused is four times as great as with a 3¼ x 4¼ camera. To take a practical example: Suppose we wish to photograph a machine which is 12 feet long. Then, with a small camera, if we stand 12 feet away and focus on the middle of the machine, we shall get the whole machine sharply defined with the full aperture. If, however,

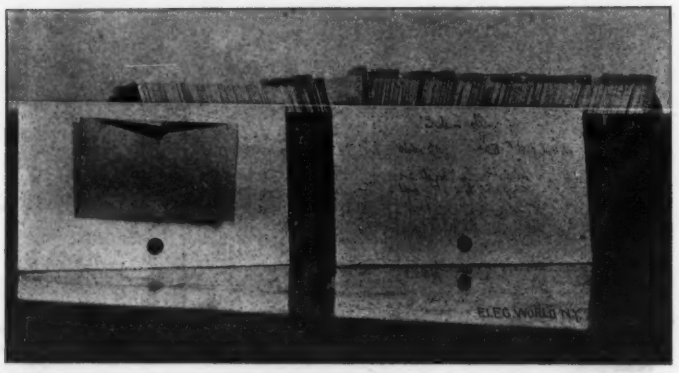


Fig. 4.

we use the larger camera, then on focusing on the middle of the machine the only parts which will come out distinctly will be those lying 18 inches before and behind the middle of the machine. Everything else will be blurred. Even if we reduce the size of the stop we shall not get such a sharp picture as with the small camera, and the exposure will need to be about 100 times as long to get any result at all comparable with that given by the small camera. In an actual case I have taken a photograph in a shop of a machine in operation in one fifth of a second with a Zeiss Satz-Anastigmat lens and 3¼ x 4¼ inch plate, where, on repeating the operation with a 6½ x 8½ lens of the same make it took 30 minutes, the machine, of course, having to be stopped. The enlargement from the small plate was found even then to be superior in general definition to the picture taken with the large camera. Another advantage is the fact that lantern slides can be made direct from the plates without the necessity of a previous reduction. Other advantages are, the less expense of plates; the ease of carriage, since the plates weigh only one eighth as much and the camera need not be larger than 3 x 4½ x 5½ inches; and the fact that a great deal of work can be done with the small camera, where short exposure is necessary, which is altogether outside the capacity of a large camera. It is absolutely impossible, for instance, to make a photograph of a lathe while it is working, with a large camera, while with a small one there is no trouble.

In passing I may say that with small cameras there is no object in having them fitted with swing backs, as they increase the size of the camera to about double, and if for any cause it is desired to take a photograph of an object very much higher or lower than the observer, a case which will not occur once in a hundred times, the distortion is readily removed in making an enlargement by slanting the negative and the plate on which the enlargement is to be made in opposite directions. This will make the picture come out true. A rising and falling front is a necessity, however.

Films I have never found satisfactory with a small camera. Moreover, there is no object to be gained, as it is an easy matter to take along a couple boxes of plates, if on an extended trip, recharging the plate holders in daylight by using a velvet sleeve, both arms being slipped into this up to the elbows, the plates and slides being easily manipulated by touch.

As regards lenses, it is useless to buy a lens which does not cover the full plate sharply and anastigmatically at least f.8 aperture. Such lenses are the Zeiss, Goerz and Turner lenses. Any one of these will give good results, but poorer lenses must be stopped down so far that they cannot be used for instantaneous work inside buildings.

The writer has spent a good deal of money in experimenting on this subject, and has tried a number of cameras, but the ones mentioned here—*i. e.*, a small camera, taking plates about 1¼ x 1½ inches, for use in copying data ; a 3¼ x 4¼, for taking photographs of machinery, etc., and of large plans, and an enlarging apparatus, are the only ones which I now have any use for. These do all the work necessary and do it well. It is hoped that this description may be of use to those who have met with difficulty in the collection of engineering data.

The success of this method has caused the writer to indulge in some speculation as to the possibility of an extended use of the photographic method for publishing books. The smallest writing of which the writer is aware is that mentioned by Morton, *Cassier's Magazine*, August, 1895. This specimen referred to is so small that 6,000,000 words of similar size would go within the space of one square inch. A little calculation shows that letters one-fifth the size could be plainly read with a microscope of the highest possible power, so that the theoretical limit would be 150,000,000 words per square inch. The last number of The Electrical World contained 32 pages of reading matter of 2000 words each. The photographic plate one inch square would thus contain the whole of the reading matter of the paper for about 50 years, or 300 volumes the size of the annual report of the transactions of the Institute of Electrical Engineers.

This is almost inconceivable, for 300 volumes of a thousand pages each is a fair sized library. But the only thing that till recently stood in the way of its practicability—*i. e.*, the coarseness of the grain of ordinary photographic plates, has been removed by Lippmann in the beautiful experimental work by which he has made Rayleigh's proposed method of taking colored photographs by interference methods an accomplished fact.

Even with a magnification of 30 diameters, instead of the 600 which I have assumed in the previous calculations, one such volume would go on a plate one inch square. At this rate a box one foot cube would contain a library of 50,000 volumes, or 1,500,000 with the larger magnification.

However startling this may seem, it is not impracticable, at least for the lower power mentioned, and it is well within the bounds of possibility that the scientific student of the future will do his book work with the aid of a small projection lantern and a library of small positives, purchased at a small fraction of the price now paid. The thing is infinitely more practical than the proposition, seriously made and received, that phonograph cylinders should take the place of books. It would take a man five years, reading at the rate of 150 words per minute for 10 hours per day, to utter the words which may be contained on a piece of glass one inch square, while, as regards ease of reference to a particular part of a work, there is no comparison. It would be an extremely easy matter, for instance, to arrange the mechanism of a plate containing a German dictionary so that by the pressure of a couple of keys the page commencing with any given letters would be thrown on the screen instantly.

Cable Memorial.

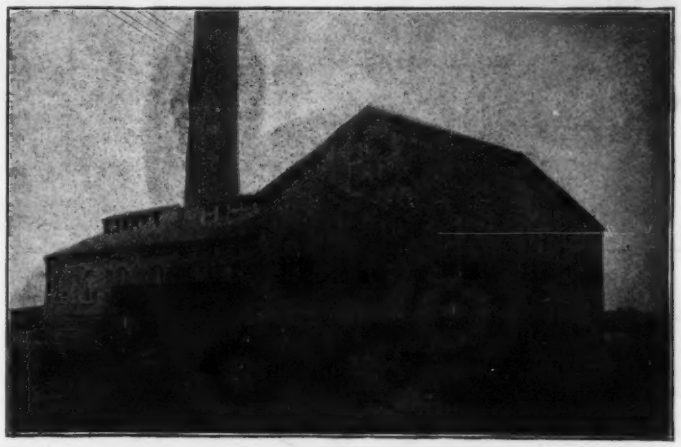
A despatch from London states that a financial committee is about to be formed to inaugurate an international memorial to commemorate the inception and extension of submarine telegraphy, connected with the names of Cyrus W. Field, Sir James Anderson and Sir John Pender. The Marquis of Tweeddale, chairman of the Anglo-American and Eastern Telegraph Companies, makes the announcement.

THE ELECTRIC RAILWAY

The Midland Railway of Staten Island.

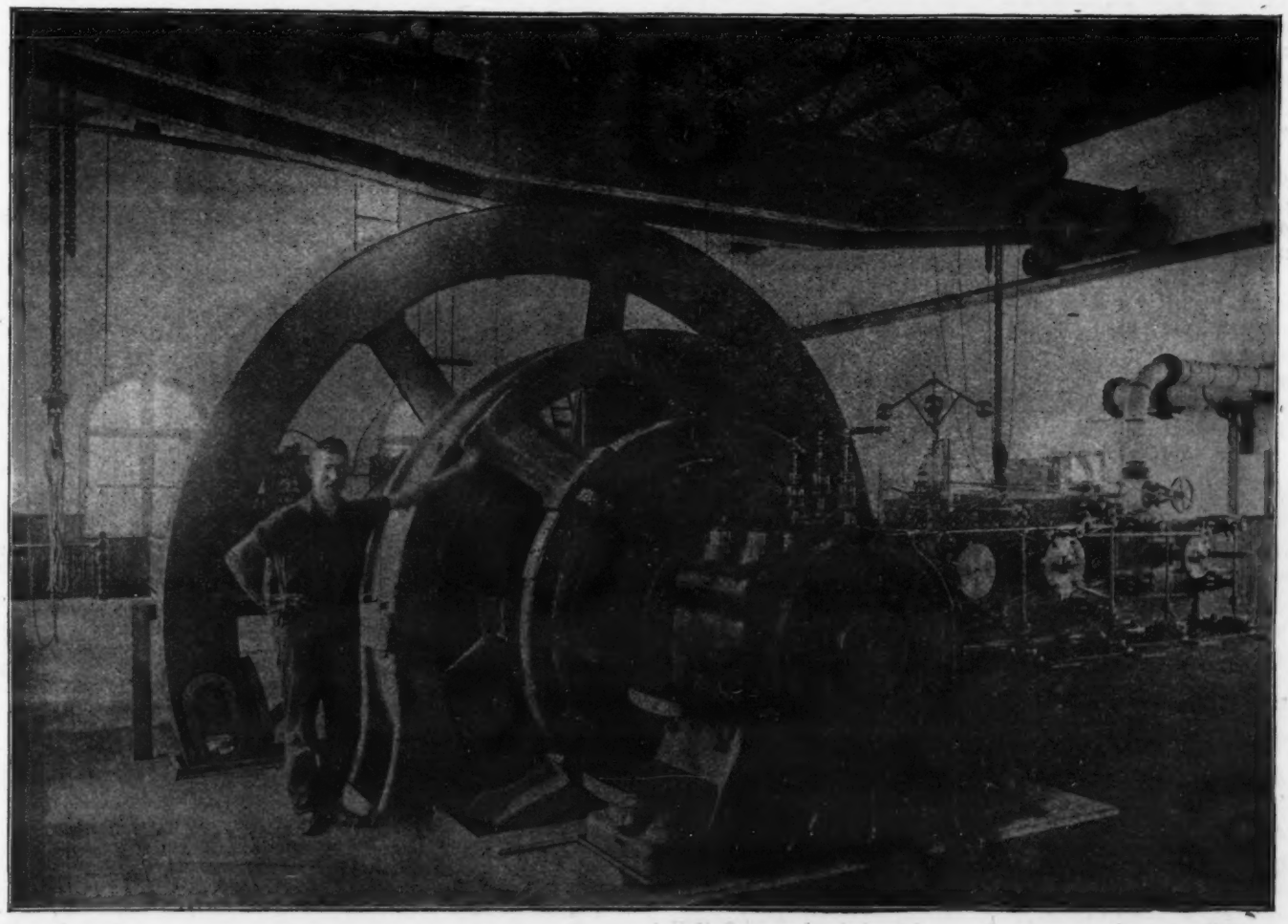
Staten Island, which will soon be a part of New York City, is 13 miles long and 10 miles wide at its widest point, and covers more than twice the area of Manhattan Island. The northern end of it is nearer to Wall Street than is Harlem, and may be reached by a far more pleasant ride, yet parts of the interior are as primitive and rural as they were 50 years ago, when Commodore Vanderbilt ran the ferry to the city and his wife kept the inn on the Island. Now, however, railway companies are extending their lines along turnpikes and across farms, and Staten Island promises soon to be a second Brooklyn in this respect. For years the only means of transit on the Island were the steam cars of the Staten Island Rapid Transit Company, extending across and around the northern shore and connecting at St. George with the ferries plying between that point and the Battery in New York City. A year or so ago the Staten Island Electric Railway Company built a line along the north shore, paralleling the rapid transit road from the Elizabeth Ferry to South Beach. A third company, the Midland Railway Company of Staten Island, has started cars within the last few weeks, and a competition is in progress which will startle the old inhabitants.

The main line of the Midland road extends north and south the whole length of the island, from the St. George landing place of the New York ferries to Tottenville, opposite Perth Amboy in New Jersey. Its course is *via* the towns of Tompkinsville, Stapleton, Clifton, Concord, Garretsons, Richmond, Rossville and Kreischerville to Tottenville. The line, however, is completed only at present as far as Richmond. From Concord branches run via Castleton Corners to West Brighton and Port Richmond on the north shore, and another branch will connect the main line with the beach on the lower bay. Nineteen miles of track are now laid and five miles more are under construction. Five miles of this track are of 93-pound girder-rail, the balance being 65-pound T-rail of the New York Central pattern. The joints are bonded with two No. 0 plastic bonds to each. The overhead equipment was made by the New York Electric Works. No. 0 trolley wire is used. Fifteen miles of feeder, having a cross section of 500,000 circular mils, distributes the current. The line is divided into three sections, each of which is insulated from the other, and are supplied through three feeder panels at the station.



EXTERIOR VIEW OF POWER HOUSE.

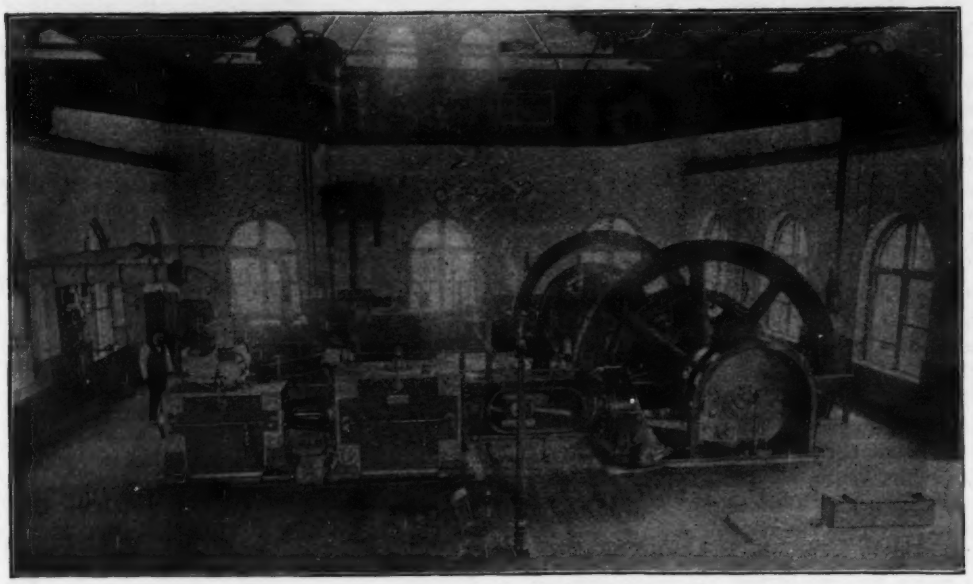
Forty cars are in use, all made by the St. Louis Car Company, and mounted on St. Louis trucks and equipped with General Electric 800 motors. Twenty-five of these are open cars. The closed cars are vestibuled, and are as perfectly appointed as it is possible to make them. They are finished in mahogany, and the seats are of rattan, upholstered and plush covered. Each is lighted by 10 lights, with a combination switch for changing the platform lights. Curtains are provided on the end windows and doors for the complete darkening of the front vestibule, as it has been found that the motorman



DIRECT-CONNECTED SIX-POLE GENERATOR.

can see better at night in the dark country roads if he is himself in the darkness. In the panels between the windows are push-buttons connected with electric bells on the platforms, to enable the passengers to easily and gracefully signal the conductor. The cars are heated by Consolidated electric heaters.

The power station is located near the centre of the system, at Grasmere. On one side of the station is the track of the steam railway company and on the other is a large pond from which feed and condensing water is drawn. The building is an L-shaped structure built of brick, with steel trussed roofs.



General View of Interior of Power House.

The boiler room is 35 x 85 feet and the engine room 50 x 80. A brick stack with a 6 x 6 flue 125 feet high rises from the centre of the boiler room. A spur of the steam railway runs up an incline and over the coal pockets which line the front wall of the boiler room. The coal is dumped direct from the cars into these pockets, which will hold 100 tons, and is then shoveled from them into the fires without further handling. No. 2 buckwheat hard coal is used.

Three Berry safety boilers are now in place, each having a capacity of 250-horse-power. They are of the vertical cylindrical type, with horizontal fire tubes and are fitted with revolvable casings and steam jets so arranged that the tubes can be cleaned by a steam blast while the boiler is making steam. The boilers are only 9 feet in diameter by 13 feet high. Space has been left for a fourth of the same size.

Two engines are now in service, with foundations built for a third. They are tandem compound of the horizontal Corliss type, made by the Robert Wetherill Company, of Chester, Pa. The cylinders of both engines are 16 and 30 by 48, and run at 100 revolutions per minute. They are rated at 450 horse-power each. The engines are run condensing, a Wetherill independent jet condenser taking care of both. The engine room floor is raised about ten feet above the street level, which allows plenty of room underneath for examination of the steam fittings, etc. The boiler room being on a level with the street, the steam pipes running from the top of the boiler are brought to the engines at a height of about six feet above the engine room floor. The system of oiling the engines is very complete. All main surfaces are supplied by gravity through a pipe running from a large tank having ten barrels capacity, supported on the engine room wall. After performing its functions the oil flows from the oil pans by gravity to the filters, located in the basement and after passing through three of these it is pumped back to the tank in the engine room by a small Worthington duplex pump. A trolley running above the basement tank is fitted with a chain tackle which enables one man to pick up a barrel of oil, swing it on the tank and empty it with ease. All piping, excepting for the live steam, the generating leads, etc., runs under the floor, which leaves the overhead space entirely clear

The engines are direct-connected to 300-kw General Electric generators of the most up to date type. The generators are six-pole and the field castings are of steel. Both units are of the most substantial construction. One generator is at present carrying the entire load, which, however, is only about one-half its rated capacity. The generator shaft is 50 inches in diameter and weighs 9 tons. The armature weighs 11 tons, and the split fly-wheel is 16 feet in diameter and weighs 20 tons.

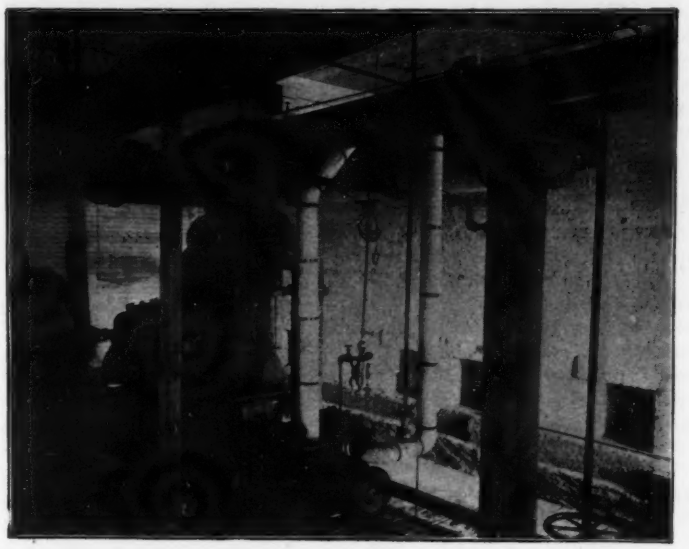
The switchboard is placed at one end of the room, and is fitted with six slate panels, three for the dynamos and three for the feeders. Single pole knife switches with a quick break spring opening are used. The equalizer does not run to the switchboard at all but merely under the floor from generator to generator, and is connected by switches mounted by the side of each. This method serves not only to simplify the switchboard connections, but to improve the equalization on variable loads, as the resistance of the equalizer is greatly reduced. A Weston station ammeter measures the total current output of the station and a similar voltmeter is mounted on a pivotal bracket hung before the engine room condenser. The 20-ton crane built by Messrs. Speidel & Roeper, Reading, Pa., travels the whole length of the engine room.

Boiler Room.

Map of Midland Railway System.

At Concord, where the lines of the system converge, a new car shed is being built. The structure will be 110 x 300 feet, and will have a capacity of 72 cars on eight tracks. The interior of the house is divided into three sections by two fire walls. In order to reduce the fire risk, one half of the tracks is built on trestlework over an excavation four feet deep, which will give ready access to the motors. The repair shops, conductors' rooms, offices, etc., will be included in the building.

About two miles below South Beach, on the shore of the lower bay, the Midland Company has established a new Summer resort which will be similar to Manhattan Beach. The company has



JET CONDENSER.

bought and will retain possession of all the land, which will permit it to dictate the nature of the attractions. More than $100,000 is being spent by the company alone in making improvements on this property. Upon the completion of the new ferry terminal at St. George, into which the Midland road will have an elevated entrance, a through service will be inaugurated. A ride of six miles will be made in about 35 minutes, making the trip from New York City one hour in length. A large patronage will undoubtedly be received on this route during the Summer months.

Meeting of the Chicago Electrical Trade.

A meeting of the representatives of the electrical trade of Chicago was held at the Tremont House July 30, 1896, for the consideration of the advisability of organizing a credit association, similar to that existing in Philadelphia at the present time.

The following firms were represented: Washburn & Moen, J. A. Roebling's Sons' Company, Central Electric Company, Electric Appliance Company, American Electrical Works, Anchor Electric Company, Bryant Electric Company, S. F. B. Morse, American Circular Loom Company, Standard Underground Cable Company, George Cutter, Chicago Edison Company, Western Electric Company, Osburn Bros., Dearborn Electric Company, Chicago General Fixture Company, Chas. E. Gregory, Sunbeam Incandescent Lamp Company, Leschen-Macomber-Whyte Company, New York Insulated Wire Company.

The meeting was called to order by Mr. F. Overbaugh, and a temporary organization was effected by the election of Mr. F. Overbaugh as chairman, and Mr. Jas. Wolff as secretary.

The object of the meeting of a permanent organization was discussed at considerable length, and many valuable suggestions were made.

The chairman was authorized to appoint a committee of two to confer with the chair to select a Committee on Permanent Organization, and to investigate the plumbers' and kindred organizations for the purpose of obtaining information for the benefit of the proposed association, the temporary officers to be the ex-officio members of the latter committee. The chair appointed F. S. Terry and George Cutter, and the committee retired for consultation. The committee reported later that the Committee on Permanent Organization be as follows: W. M. Carpenter, of the Western Electric Company; C. Brown, Central Electric Company; W. N. Anthony, of the Chicago Edison Company. The report was unanimously adopted. The meeting then adjcurned subject to the call of the chair.

Convention of the Street Railway Association of the State of New York.

The fourteenth annual convention of the Street Railway Association of the State of New York will be held at Hotel Bennett, Binghamton, Tuesday, Sept. 8, at 10 o'clock a. m.

It is the intention of the association to make the meeting one of especial benefit and importance. A feature of the programme will be the reading of several papers upon subjects of everyday importance to street railroad men. All papers prepared and read before the convention will be brief and concise, 12 minutes being the limit of time allotted to each.

It is intended to make the exhibit of supplies, small models, etc., a prominent feature of the convention, and ample room will be provided (free of expense), for all who desire to make a display.

Aside from the banquet, which will be held at 8.30 p. m. at Hotel Bennett, the Binghamton Railway Company has arranged a programme of entertainment, including a trolley ride to the various points of local interest, terminating with a 10-mile ride to Union, with luncheon at the Casino, provided by the Binghamton, Lestershire & Union Railway Company.

Convention of the Pennsylvania Street Railway Association.

The fifth annual meeting of the Pennsylvania Street Railway Association will be held in Altoona on Sept. 2 and 3 next, and there is every promise that it will be the largest convention ever held by the association. The programme will be one of unusual interest to those engaged in the electric railway business. The second day will be devoted to pleasure. The convention will be called to order at 11 a. m., Sept. 2, in the Casino at Lakemont Park, Altoona, and continue during the day. A number of scientific papers will be read and discussed, and the interests and welfare of the business generally considered. On the second day an excursion will be made over the lines of the Altoona & Logan Valley Electric Railway Company. A trip to "Wopsononock" will also be made, and in the evening a banquet will be held at the Mountain House, Cresson.

The Logan House, Altoona, will be the headquarters of the association and will furnish accommodations at $2.50 per day. Mr. S. P. Light, Lebanon, Pa., is secretary of the association.

Sympathy for Embarrassed Engine Builders.

The Armington & Sims Engine Company, Providence, R. I., at a meeting of its stockholders has decided to ask its creditors for an extension of three years on its indebtedness. The company owes $275,000, and has assets amounting to $270,000.

Those who remember how much Armington & Sims did for electric lighting in the early days will sincerely regret the present financial difficulties of the company and hope that they may be but temporary.

When the electric light was first introduced, one could count the pulsations of the engine in the flicker of the light. Mr. Pardon F. Armington and Mr. Gardiner C. Sims were the first to design and build a high-speed, closely governing engine especially adapted to the driving of dynamos, and their engine has done excellent work in electric light and power stations in every quarter of the globe.

Railway Return Circuits.

In an article which appears in *L'Eclairage Electrique*, M. Blondel describes the return circuits for electric railways. He states that the difficulties should not be met by new devices, but by the application of well-known principles for lighting, namely, the providing of sufficient conductivity. This he believes can be accomplished by welding the rails. The rails should have a cross-section of at least 80 times that of the feeders, at the same time providing return feeders equal in size to the outgoing. These should be connected at points along the rails corresponding to the points of tapping on to the trolley wire.

DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE

BY CARL HERING

COMPILED FROM THE PRINCIPAL FOREIGN AND AMERICAN JOURNALS.

DYNAMOS, MOTORS AND TRANSFORMERS.

Polyphase Motors. VON DOBROWLSKY. Lond. *Elec. Eng.*, July 31.—An interview of a correspondent of that journal with this engineer. He was one of the first workers in the field and has made many improvements in details which are now in general use by his company (The General Electric Company, in Berlin); the larger proportion of the total output of the machines of his company are for the three-phase system. Regarding the question of drop of potential for lighting purposes he states that it has been much exaggerated, for with carefully designed machines it can be kept within 5 per cent. between no load and full load; he invariably uses the star method of coupling the fields of the generators and has had no complaint of bad regulation. A brief description is given of a large three-phase plant which is being erected near Berlin at Obersprée; the current will be developed at 6000 volts and will be transmitted to the various suburban districts around that city; the charge for power will be 2.5 cents, and for light 12 cents per kw-hour; the rate of discount will be based on the lamp-hours by dividing the units consumed by the maximum power required for the lamps; a large number of electric railways will probably be supplied from this station. He prefers the non-synchronous motor for the rotary transformers; in efficiency when loaded, there is nothing to choose between the synchronous and the non-synchronous, but in the power factor the synchronous has its only advantage; a non-synchronous motor of large output will take 10 to 15 per cent. more current for a given power than the synchronous one, but this is more than compensated by the increased facilities for starting it and the driving is much more flexible owing to the slight variations in speed, which prevents undue strain, and it will pick up its load again after an accidental short circuit has been removed. His company uses the three-phase system entirely throughout its works for driving the machine tools, carrying the subdivision of the power to an extreme; assuming that 200 motors are required in this case, he points out the advantages in comparison with the direct-current system, of not having the 200 commutators and 400 brushes to attend to, while the latter would also form an important item in the cost of maintenance; the construction of the moving parts is also stronger for three-phase motors, and moisture in the rotating part does no harm. Regarding the starting torque and current he states that small motors connected directly to the mains would take four or five times the normal current, giving three or four times the normal torque, which is seldom required, and the current can therefore be reduced to advantage; if, however, the generators are large compared with the motors, there is no objection to connecting them directly to the mains; this is done up to five horse-power, and for larger sizes the starting current is kept down by a transforming device; for small motors he does not use resistances in the armature circuit, as it requires collector readings; a better way is to change the connections from a triangle coupling to a star coupling when starting, in which case the normal torque will be obtained in starting with only 1.5 times the normal current; where fluctuations are to be avoided a resistance is placed in the induced circuit, the regulation being effected on the low-pressure side; with a 300-hp generator, a 10-hp motor can be switched on directly without affecting the lighting; for centrifugal apparatus in sugar refining, where a large mass must be accelerated, he gives the motor more self-induction in preference to using starting resistances; a high-frequency generator is used for the motors in the carpenter shop owing to the high speed required.

Load Losses in Dynamos. MORDEY. Lond. *Elec.*, July 31; a brief discussion of the recent article by Bláthy (see THE ELECTRICAL WORLD. Aug. 1, p. 128; also the discussion in *Digest* last week).—He regrets that that paper is confined to a general statement containing no details of tests (see THE ELECTRICAL WORLD, Aug. 15, p. 188) or other particulars on which one can form an opinion; he thinks that when these are received it will be found that he actually made an interesting discovery, and it will then be shown how this load-loss effect is caused and how it may be prevented; Mordey has never come across this loss in his own tests or in any publications; he considers Bláthy entitled to the full credit of the discovery; he (Mordey) has been under the impression that the full-load losses are often somewhat less than the sum of the no-load parasitic losses and the C^2R loss; this may be and is the case under some circumstances, as there are instances in which there is no increase of power required to drive certain dynamos when the external load is increased, and even cases where the power actually decreases; there is no necessity in the nature of things for the stray losses to increase with the load. He quotes from some tests in Hopkinson's classical paper, in which he shows that there is no evidence of any gradually increasing load-loss; the smallest loss was when the largest load was on; in some of his own tests with alternators he found no indication of an increasing load-loss; this load-loss of Bláthy is not general; if there can be a decreasing load-loss an increasing one is equally possible; a decreasing load-loss may occur if the eddy-loss at no-load is great; an increasing load-loss may occur where eddy currents are set up by the armature current acting on masses of metal beyond the reach of the field.

Alternating-Current Transformers. FLEMING. Lond. *Elec. Rev.* and *Elec. Eng.*, July 31; the beginning of the second lecture (see *Digest*, last week; these lectures are being reprinted in *El'ty* and in *Elec. Eng.*, N. Y.).—He discusses the construction of the transformer, giving formulas for the calculation of some of the parts, an illustrated description of some of the different transformers, as also some curves illustrating their operation. Regarding the thickness of the sheet iron he states that for a frequency of about 100 it is useless to make the iron less than 0.01 inch in thickness, and it is useless to laminate at all unless the laminations are less than 1 mm, that is 0.04 inch in thickness; he gives some simple and practical formulas, deduced from the complicated ones of Thomson and Ewing, for the energy of the eddy currents; the general custom is to make the plates about 0.014 inch thick, and the standard induction is 2500 lines per sq. cm, under which circumstances the formula shows a loss of 0.07 watt per pound of plates, due to eddy currents at a frequency of 100; this loss is therefore reduced to a very small amount for that thickness of plates; if the lines of magnetic induction are not always parallel to the laminations, eddy currents may be set up which are not hindered by lamination. The hysteresis loss is discussed and formulas for it are given, as also curves due to J. J. Thomson, showing the variations of hysteresis and eddy-current losses in plates of various thicknesses. In specifications for iron the standard induction is 2500 lines per sq. cm, that is 25 microwebers per sq. cm, and the standard frequency is 100, under which conditions a good transformer ought to have a hysteresis loss varying from 0.25 to 0.5 watt per pound; iron with less hystersis can be obtained, but it is difficult to keep it in this condition; the iron for core should have a small hysteresis loss rather than a large permeability. He does not approve of a grounded shield plate between the primary and secondary coils, preferring an insulating shield. He defines the term power factor; a transformer ought never to heat to more than 100 degrees C., and for every watt lost in it there should be at least 3 to 4 square inches of cooling surface; the idea that oil could be used as an insulator and that it would heal after the passage of a spark is not confirmed by experience; the battle between open and closed circuit transformers was decided long ago, the former having no advantage over the latter in respect to core-loss, and they have a decided disadvantage in a smaller power factor; the copper and the iron losses at full load should be equal to each other; the iron-loss, secondary drop and power factor at no load are greatly affected by the form of the curve and the core-loss is therefore not a quantity inherent in the transformer itself; this he discusses and illustrates with curves; with a peaked form of curve the iron core-loss is less and the secondary drop greater, than for a rounded or square shouldered form.

Experiments with the Phasing Transformers. FERRARIS and ARNO. *L'Eclairage Elec.*, July 18.—These accumulators form part of the system referred to in the *Digest* last week. With a primary current they produce a secondary at any desired voltage differing by 90 degrees or any other amount from the secondary current obtained by the ordinary transformers; this transformer contains two fixed coils, one a primary and the other a secondary, the number of windings of which depend on the voltages; they are placed relatively to each other like the two coils of a non-synchronous biphase motor so that their mutual induction is zero; a short-circuited armature rotates by the action of the primary current; the magnetic flux generated by the primary does not traverse the secondary, but both the coils are in a revolving magnetic field whose speed corresponds to the frequency; it may be considered as formed of two transformers, the revolving armature representing the secondary of the one and the primary of the other, the primary of the first and the secondary of the second being the two coils of the phasing transformer. It is shown how the calculations of this differ from that of the ordinary transformer; they should be made as though it were a double transformer taking into account the non-synchronism of the armature; if the ohmic resistance of the secondary is diminished and the secondary current increased, the phase shifting increases from zero to 90 degrees while in the ordinary

transformer the phase shifting decreases between the same limits; a table is given showing the phase shifting under different circumstances.

Influence of the Shape of the Wave on the Iron Losses of Transformers. BEETON, TAYLOR and BARR. *Jour. Inst. Elec. Eng.*, July.—A reprint in full of their Institution paper with the discussion (see THE ELECTRICAL WORLD, June 13, p. 710).

Rotary Field Motor for Lecture Purposes. GANZ. *Elec. Eng.*, Aug. 12; reprinted from the *Stevens Indicator*.—An illustrated description of the one made for the Stevens Institute for illustrating the principles of a rotary field.

LIGHTS AND LIGHTING.

Negative Resistance. HEAVISIDE. Lond. *Elec.*, July 31; a contribution to the discussion.—He assumes it to mean that if a body obeyed the Ohm's and Joule's law, but with R a negative quantity, it would possess a negative resistance; the effects of such a resistance have been discussed by him in his papers, and are interesting and instructive, but he has no faith in the permanent existence of such a body, yet he is not prepared to deny that a substance might temporarily behave approximately as a negative resistance, especially if in a state of continuous material change.

GRAY. Lond. *Elec.*, July 31.—A clear presentation of the subject with his criticism. As he understands the matter, it has been stated that in certain cases the arc yields electric energy to the circuit at the rate of aA^2, in which a is positive, when at the same time there is a greater rate of contribution EA to the arc by the circuit, owing to the back E. M. F. E (A represents the current); the total rate at which the energy is given to the arc is therefore the difference between the latter and the former, and this the authors of the original paper prefer to describe by calling the $-a$ the true resistance of the arc, which then is negative; Prof. Ayrton urges that if the result had been what it is in another class of cases, in which it is the sum of these two quantities, then a would have been regarded as the resistance of the arc without question. He (Gray) questions whether the name resistance could be given to a quantity which is sometimes positive and sometimes negative; he thinks it preferable to adopt some other terms which do not confuse the ideas; the physical facts had better be described without the use of the term resistance at all; the term negative resistance would be as objectionable as negative dissipation of energy; that which is to be compared with or distinguished from an adjuvant E. M. F. is not the $-a$ of the above expression but the product of this by the current; the multiplier $-a$ is a scalar which is sometimes negative and sometimes positive; it is essential to its scalar quality that a reversal of the current should not alter its sign; the product $-aA$ changes sign with the current, so that $-aA^2$ still has the same sign. Regarding the nature of resistance, he has long believed that in an ordinary metallic conductor there is a back E. M. F. due to molecular dynamos which are driven by the current, developing a counter E. M. F. proportional to the current; the work done by these dynamos is dissipated in overcoming frictional resistance; if a metallic conductor free from resistance could be tested with sufficient rapidity it might show polarization; but when this E. M. F. is not a back but an adjuvant E. M F., there seems to be a difficulty; this he discusses in connection with the same theory and he suggests that there might be something in the arc molecularly corresponding to this; there is no paradox in having a forward E. M. F. proportional to the current associated with a greater back E. M. F. which is either constant or varying. He recommends not using the term true resistance for any quantity measured in the arc until the physics of the subject has been more fully investigated.

Jandus Lamp. TOERRING. *Elek. Zeit.*, July 30; a reply to the article noticed in the *Digest*, June 27.—He claims that the unsteadiness of the light was due to moisture, only a slight amount of which suffices to produce this effect; with moisture in the air the crater will become appreciably smaller; they should not have used cored carbons as the material of the core deposits on the glass and absorbs considerable light; he believes that the carbons used contain much ash; the large number of enclosed arc lamps used in the United States he considers sufficient evidence that they are satisfactory; a reply will be published in the next number.

Lighting Staircases. Zeit. f. Beleucht., July 30.—An illustrated description of a recent patent granted to the General Electric Company, Berlin, for a system of switches by means of which all the lights may be turned on at the bottom and turned off on any of the floors.

Peculiar Lamp Accident. EDEN. *Elec. Eng.*, Aug. 12.—An illustrated description of an incandescent lamp which was mounted in a horizontal position, and had been covered with a towel while it was lit; the heat softened the glass so that it bent into an almost vertical position; the cloth was badly scorched, but did not ignite, nor did the lamp break.

True Resistance. APPLEYARD. *Elec. Rev.*, Aug. 12.—A reprint of the article noticed in the *Digest* last week.

POWER AND HEAT.

Transmission of Power by Alternating Currents. MORRIS. Lond. *Engineering*, July 17 and 24; a reprint of a recent paper.—It is quite general in character, and to some extent elementary; it contains a list of the three-phase plants erected by the (U. S.) General Electric Company, and also a list of alternating-current power transmission, both in this country and abroad, in both cases giving some tabulated data for each plant.

Utilization of Water-Power. STEIGER. *Jour. Inst. Elec. Eng.*, July.—A reprint in full of his recent paper (see *Digest*, June 20, 27 and July 4) with the discussion.

Electric Dredge. L'Eclairage Elec., July 18.—A brief description, without illustrations, of one used in Spain, which is said to be a more perfect arrangement than the one used in this country.

Improvements in Thermo-Electric Batteries. ASHER. *Elec. Rev.*, Aug. 12.—After giving a brief history and discussing the subject of the losses, he offers several suggestions for securing better economy in the usual type. The first method is to use the regenerative principle, by having the air which feeds the furnace pass over the ends of the couples which are to be cooled and thereby absorbing the heat from them. The second method is to use an artificial draught, which he claims may be maintained much more economically than a natural draught, which latter requires a high temperature of the escaping gases; to accomplish this he uses several rows which are acted on successively by these gases, each one receiving heat at a lower temperature than the preceding one; to reduce the first initial temperature, which is too high, he mixes air with the gases. The third method is to use "the outer ends of the first set of elements as a source of heat for another or second set of elements, the ends of which are nearly in contact therewith," and so on throughout the series; there is no advantage in having the heated ends more than 90 degrees hotter than the cold ones, and this is accomplished by the present arrangement; he suggests having about 10 sets of elements; he believes that the efficiency will prove to be higher than that of any heat engine; a calculation gives him an efficiency of 57 per cent. if the second law of thermo-dynamic holds good.

Power Required for Wood Working Machinery. DODGE. *Elec. Eng.*, Aug. 12.—The reports of tests made at the Washington Navy Yard giving the size of the machines and the power necessary to drive them under given conditions.

Transmission at Rheinfelden. RATHENAU (not Rathnan) *Elec. Eng.*, Aug. 12.—A brief abstract, with some of the illustrations, of the article noticed in the *Digest*, July 25.

TRACTION.

Return Currents from Railways. BLONDEL. *L'Eclairage Elec.*, July 18.—An article of some length discussing the question of the distribution of these currents; he considers only the case of a network of wires; he assumes first that both the outgoing and the return lines are insulated and then finds the modifications resulting from using the rails for the return. In his conclusion he states that the question of the return by the rails ought to be met without new artifices, by the simple application of the well-known processes for the distribution for light, the first essential principle of which is to get electric conductivity, preferably by welding the rails, which he thinks is the only truly rational method; the return circuit should be treated precisely as for lighting, except that greater variations in the potential may be allowed, the relatively less cost of iron as compared with copper being also taken into account; the rails should therefore be proportioned that their section is at least 80 times that of the leads, and that return feeders equal to those for the outgoing current should be used and connected to points corresponding as nearly as possible to those of the outgoing feeder; these return feeders should be used only when it is possible to increase the size of the rails or to have well conducting joints; the potentials should be measured by means of pilot wires; the only economy to be realized in the circuits is that arising from the lower price of the steel as compared with the copper.

Traction Diagrams. TOMLINSON. Lond. *Elec. Rev.*, July 31; a continuation of his serial (see *Digest*, last week).—He discusses the subject of stopping and starting and applies his diagrams to a case, making allowance for the energy consumed at starting and assuming a drawbar pull per ton of 52.5 pounds for generating the full speed of 10 miles per hour in 20 seconds, that is, in 150 feet; he finds that acceleration costs more in power on the average on a perfectly level line than on a graded line, considering both the outgoing and return trips; he uses for convenience a constant drawbar pull as an accelerating force throughout the whole period of acceleration, which is the most efficient way and is affected by steam locomotives but not by the electric motors, which is a defect of the latter; he then describes a more convenient and more accurate method to find the allowance for stops, a description which cannot be abstracted. This is followed by some notes to be read in connection with this article showing what is required in the form of instruments and data, in order to get the comparison of the power required with that expended according to his method.

Electric Traction in the Sewers of Paris. L'Eclairage Elec., July 18.—An illustrated description of the system now in use, which has been referred to before in these columns. For the traction a chain is used which runs through the sewers and over a pulley on the boat, to increase the adherence of the chain to the pulley; the magnetic system of De Bovet is used; the power is obtained from 60 cells of Fulmen accumulators, which can furnish 60 to 65 amperes for 2.5 hours, corresponding to a discharge of five amperes per kg of plates.

Open-Conduit Systems. Dawson. Lond. *Engineering*, July 31.—An installment of his long serial in that journal on electric traction, giving illustrated descriptions of a number of open-conduit systems.

Compressed Air Car. Sc. Amer., Aug. 15.—A brief illustrated description of the one used on Third Avenue, New York, operated by the Hardie system.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Cost of Light and Power. Lond. *Elec.*, July 31.—A note referring to an isolated plant at Nottingham; there is a 60-hp water-tube boiler, two 25-hp engines, one 500-light dynamo, another of 25 horse-power for the motors; there are also electric fans, electric irons, etc.; all the lighting, ironing, heating and ventilating in this establishment are done electrically; the cost for the past three months has been carefully noted, and after allowing 10 per cent. for depreciation, and including all other charges, the cost of generating amounts to 2 cents per kw-hour.

Belfast. McCowen. Lond. *Elec. Eng.*, July 31.—A reprint of a long paper describing this plant in which a three-wire, low-tension system is used in connection with accumulators, the power being generated by gas engines taking gas from the city gas works. It includes two tables, giving the results of tests for various loads of a tandem gas engine and a single-cylinder, double-acting gas engine. From the records of the station for almost a year the total efficiency was 91 per cent., the loss in the batteries 6.7, and that in the mains 2.3; the total maximum supply was 159 kilowatts; it includes no illustrations.

Rome. Lond. *Engineering*, July 24.—A well-illustrated description of the combined light and power plants in that city, in which alternating-current transmission is used in connection with accumulators, which latter are used for the railways during the time when all the energy of the station is required for lighting.

Rules and Regulations in Japan. Lond. *Engineering*, July 31.—A note giving some of the regulations issued by the Government regarding electric plants.

Organization of an Electricity Works Staff. Ruthven-Murray. Lond. *Elec.*, July 31.—A reprint apparently in full of a recent Municipal Association paper, with the discussion.

Buffalo & Niagara Falls Electric Light & Power Company's Plant. Dunlap. *West. Elec.*, Aug. 15, and *Elec. Eng.*, Aug. 12.—A very brief illustrated description; it is claimed to have the greatest amount of electrical energy at its command of any similar concern in the world; it is the distributing agent in and about Niagara Falls for the electricity generated by the Niagara Falls Power Company.

Belfast. El'ty, Aug. 12.—The beginning of a reprint of the paper noticed above.

Municipal Ownership. Monroe. *Elec. Eng.*, Aug. 12.—A criticism of the recent article by Bean (see *Digest*, Aug. 8) with suggestions of some corrections which make a decided difference in the lighting account. A short communication by Bridges, of the South Haven, Mich., plant, published in the same issue, also makes some corrections in the article by Bean, which he claims does injustice to the officials of his village.

Detroit Municipal Plant. Eng. News, Aug. 13.—An abstract of the recent first annual report.

Incidental Points About a Central Station Plant. West Elec., Aug. 15.—A short anonymous article favoring high tension systems.

WIRES, WIRING AND CONDUITS.

Proper Use of Safety Fuses and Magnetic Circuit-Breakers. Baxter. *Elec. Eng.*, Aug. 12.—He believes that the only sphere of usefulness of the fuse is in the protection of branch circuits; in the main circuit they are of little if any value and will afford very little protection; the question has arisen whether it is advisable to use station safety cut-outs of any kind, as the breaking of the circuit causes dissatisfaction among the customers and it may be better to suffer the loss of an armature now and then; he thinks there is much truth in this argument; the use of safety devices may be entirely discarded in central stations without incurring the danger of burn-outs, if the capacity of the engines and generators is properly proportioned; when a number of generators are run by a single engine, each one supplying an independent circuit, safety devices may be used, but they may be made to come into action very seldom, all the necessary safeguard being obtained by making the power of the engine less than the combined capacity of the generators and having the generators maintain a constant E. M. F.; the general principle is to have the engines of sufficient power to drive the generators at their maximum output and still have a margin for an emergency; but it is these emergencies that are fatal to the generator, and to provide the engine with reserve capacity is to provide it with means for burning out armatures; if the steam engine is overloaded it will suffer no injury. If the generators are not in parallel there is little or no danger of burn-outs if the capacity of the machine is greater than the demands of the circuit; when each generator is driven by an independent engine the danger of burn-outs from excessive current can be removed by simply increasing the capacity of the generator, and by not making the engine larger than what is required; all cut-outs and fuses in the main circuits are therefore unnecessary, as all the protection they can afford can be obtained by simply enlarging the capacity of the generators. Fuses are of very little value when used to protect motors, as in such cases a magnetic cut-out is the only proper safeguard, and it should in that case operate with an excessive current and also with no current at all.

ELECTRO-PHYSICS AND MAGNETISM.

Alternating-Current Rushes in Condensers. Scattergood. Lond. *Elec. Rev.*, July 31; a continuation of his serial (see *Digest*, last week).—Assuming the existence of these high-frequency currents, the question arises whether they are sufficient to account for the whole of the effects observed or whether the indications of the voltmeter are also deceptive under these abnormal conditions; there is a fairly close correspondence between the voltmeter reading and the voltage, judging by the eye from the glow of the lamp, hence the voltmeter may be considered as properly indicating the mean square pressure at the lamp terminals. He nevertheless thought it better to resort to actual measurements to determine whether a skin effect is taking place in the filament, thus virtually increasing its resistance; two of these are described; if such a skin effect exists the watts expended in the filament should be less on a sparking circuit than when the lamp is supplied by a steady alternating voltage of the same amount; he therefore arranged a calorimetric test, which showed that there was no sensible skin effect; another test was made with a Cardew voltmeter in parallel with an electrostatic instrument, in which case it should show a lower pressure if there is a skin effect in the wire of that instrument; no such difference in the readings was found; the inference is that the oscillations are either comparatively slow or else quickly dampened out of existence. Other experiments tend to confirm the theory of the existence of high-frequency voltages and also indicate that there actually occurs a considerable rise of pressure at the lamp, although it cannot be detected by a voltmeter; this was shown by a small spark gap in parallel with the lamp, in which sparks were seen when the lamp was run up to about what it would be with 100 volts; a vacuum tube was also used for indicating the presence of these high-frequency currents thus indicating the conclusion which was arrived at regarding the existence of much greater voltages. There thus appears to be no doubt that the charging and discharging of the condenser is accompanied by a rise of pressure in the circuit and it is difficult to explain this except by the assumption of rapid oscillations; he also showed that Hertzian effects are produced in the neighborhood of the spark gap tending to confirm the view that oscillations exist.

Theory of Moving Electrons and Electric Charges. Larmor. *Phil. Mag.*, August.—A short reply to a recent criticism by Morton (*Digest*, June 27) of a former paper of Larmor; he claims that Morton made assumptions which were not contained in the original paper.

Theory of Vacuum Discharge. De Heen. *Bulletin of Belgium Academy;* noticed in Lond. *Elec.*, July 31.—He bases his theory on the oscillating motion of pith balls between two electrified plates; their velocity will increase as their size diminishes; he calculates what this will be when their size is diminished to that of a molecule and finds that it will be sufficient to produce waves of excessive shortness when such molecules impinge on glass; these waves are the extreme ultra-violet.

Röntgen Rays. Lond. *Elec.*, July 31; some brief notices of recent papers.—Dery in the *Bulletin of the Belgium Academy* concludes that there is no such thing as reflection, properly speaking; the reflected waves have different properties and probably a much greater wavelength; it is analogous to a black surface which reflects luminous rays in the form of long heat rays. He also found that a layer of collodion increases the photographic effect; to diminish the exposure he places a sheet of collodion "over the object" (probably meaning over the plate) and a sheet of tin under the plate; the polish of this tin has no influence. Battelli and Garbasso in the *Nuovo Cimento* discuss the connection between cathode and X rays and inclined to the belief that both consist of projected particles, the latter having a far higher velocity than the former. Malagoli and Bonacun found reflection from metallic surfaces and believe that the state of polish makes a difference, but their experiments are not conclusive.

Roiti's Röntgen-Ray Tube. Lond. *Elec.*, July 31; a brief, illustrated description.—It is provided with an aluminum window; it consists of a cylinder of thick glass; in a narrow neck at one end he fuses the platinum wire containing the concave aluminum cathode; the other end, which is open, is capped with an aluminum cap on the outside, serving as the anode and carefully fitted to it, being also cemented with white wax and olive oil. The tube is said to be a great success, and it was possible to carry exhaustion so far that the interior was covered with green phosphorescent light; the cap was only slightly heated; with 20 cm sparks in air he obtained good photographs of a hand in 30 seconds.

Experiments with Röntgen Rays. S. P. Thompson. *Phil. Mag.*, August.—A reprint in full with illustrations of his Physical Society paper, abstracted in the *Digest*, July 11.

Röntgen-Ray Tubes. Colardeau. *L'Eclairage Elec.*, July 18.—An illustrated article which appears to be an amplification of the one noticed in the *Digest*, July 18.

Refraction and Diffraction of X-Rays. GOUY. *L'Eclairage Elec.*, July 18.—A reprint of an Academy paper noticed in the *Digest*, July 4.

Crookes Tube. PFLAUM. *L'Eclairage Elec.*, July 18; abstracted from *Wied. Ann.*, Vol. 57, page 443.—He describes some light phenomena in the tube, which differ somewhat from those generally observed.

Polarization Phenomena in Electrostatic Fields. LOMBARDI. *Elek. Zeit.*, July 30; an abstract of an article from a Swiss journal, noticed in *Digest*, July 18, under "Measuring Potential and Dielectric Constants."—He described experiments to confirm those of Graetz and Fromm, with thin rods and discs, which, when placed in a homogeneous electric field, are subject to a torque, and which experiments can be used for measuring electrostatic forces and dielectric constants.

Dielectrics. DUHEM. *L'Eclairage Elec.*, July 18.—A mathematical article on "The Equivalents of the Flux of Conduction and the Flux of Displacement."

Dielectrics. APPLEYARD. *Phil. Mag.*, August.—A reprint in full of the Physical Society paper, noticed in the *Digest*, June 20.

Convergency of Fourier's Series. WILLIAMS. *Phil. Mag.*, August.—A mathematical article, in which he endeavors to simplify the investigation of the subject, showing in an elementary manner the nature of the difficulties and the principal results obtained, discussing also the question of the convergency of the series.

Röntgen Rays or Streams. TESLA. *Elec. Rev.*, Aug. 12.—A communication of some length, giving further arguments and results of observations to confirm the theory which he has held, namely, that the rays are streams of material particles; this he believes is the true interpretation of the nature of these rays. There is little doubt at present that a cathode stream is composed of small particles of matter thrown off from the electrode; the velocity may be as much as 100 km per second; it appears that the lumps or molecules are shattered into fragments which are so small as to make them lose entirely some of their physical properties; thus the material of the electrode, the wall of the bulb or other obstructions are of no consequence except in so far as the intensity of the radiations are concerned; no further disintegration of the lumps is attendant upon a second impact; the state of the matter is reduced to some primary form heretofore unknown; he suggests that the phenomenon may be the transformation of ordinary matter into ether; in this sense he thinks Röntgen's hypothesis regarding the longitudinal character will be confirmed; in that case there is no question of waves; he thinks the frequency must be very small—not more than a few millions a second; the statement that the amount of energy represented is very small should be received with some caution. He thinks the rays studied by Lennard are true cathode streams; the lumps of matter are probably larger and the velocity smaller than with Röntgen rays; he considers the action purely mechanical, and obtainable by other means, as for instance, by a gun loaded with mercury when fired through a thin board. He gives the results of some observations, all of which he thinks confirm the theory of the existence of streams of matter; among these are the phenomena of exhaustion; he thinks there must be an actual expulsion of matter; the relation between the opacity and the density agrees with his theory; regarding the definition of shadows, he gives the results of some experiments in which he found that the use of more intense radiations gives little, if any, better results as regards definition of details; using intense rays which affect a plate at 30 metres he obtained only slightly better results; although the screen was brighter, the shadow was not more distinct; very strong radiations often gave poorer impressions than weak ones; when taking the impressions at small distances with intense rays, a scarcely perceptible shadow is obtained, bones and flesh being equally transparent, but on increasing the distance the bones cast a shadow, while the flesh leaves no impression; at still greater distances the shadow of the flesh appears, and here a point may be found at which the definition is clearest; for still greater distances detail is lost; these facts disagree entirely with any theory of transverse vibrations but can easily be explained on the assumption of material streams; he believes the rays are all of one kind, as the above explains the apparent existence of different kinds; he thinks the velocity and the size of the particles may both differ, which accounts for the discordant results which have often been obtained; decidedly more detail is obtainable with a thick film than with a thin one, which is further evidence in support of his views; the behavior of bodies in reflecting the rays leaves no doubt that the radiations are streams of matter; there should be some trace of refraction if the rays were transverse vibrations; the source of the rays is always the place of the first impact, the second one producing little or no rays; a crucial test of the existence of material streams is afforded by the formation of shadows in space at a distance from the bulb; experiments established beyond a doubt that all bodies are transparent to very strong rays and it is impossible to explain this on any theory of transverse vibrations. Many other observations and facts might be added as further evidence.

Röntgen Photography. MORTON. *Elec. Eng.*, Aug. 12.—An extract of an article from the July number of the Bulletin of the Electro-Therapeutic Laboratory of the University of Michigan, which issue is devoted exclusively to Röntgen-ray literature. He uses the static machine extensively, but prefers the coil; quite small jars are better until the vacuum rises; very high vacua are not essential for wood working, and when the vacuum becomes impracticable the tube should be heated freely; a 6-inch spark is good and 8 or 12 is better, but a 4-inch spark will serve fairly well; the strength of the current is controlled entirely by the vacuum and must be much greater for a higher vacuum; the tubes have exceptionally brilliant moments, at which it is best to use them.

X-Rays in Intestinal Investigation. BECHER. *Elec. Eng.*, Aug. 12; an abstract from a German medical journal.—The stomach of a guinea pig may be photographed by first injecting lead salts; lime water also has a great tendency to absorb the rays; it can also be made visible by inflating air into it; the image of a guinea pig is described. He believes that much progress has been made with Röntgen ray photographs, and with increasing improvements it may turn out to be extremely useful.

Deleterious Effects of X-Rays. HAWKS. *Elec. Rev.*, Aug. 12.—A brief description of the effects noticed by this observer during continued experimentation. There was a drying of the skin, which ultimately became very painful; the hands began to swell and have the appearance of being sunburnt; after two weeks all the skin came off; the growth of the finger nails was stopped and the hair on the skin all dropped out, especially on the side of the head; the eyes were bloodshot and the vision was considerably impaired; the hands were finally protected by covering them with tinfoil.

Preparation of Calcium Tungstate for X-Ray Screens. TENNANT. *Elec. Eng.*, Aug. 12.—He thinks this is the best substance of all those known; screens the size of a body can be made at not more than 25 cents each; the spreading of the material evenly offers the greatest difficulty (but how it is best done he does not describe); two parts of sodium tungstate are mixed with one part of calcium chloride and the mass is fused to a red heat; it is then placed in water for 48 hours, which dissolves the chloride of sodium, leaving the calcium tungstate as a precipitate; the amorphous preparation made with the solutions is absolutely worthless for this purpose.

Absorption Photography and Röntgen Rays. BABCOCK. *Sc. Amer.*, Aug. 15.—A report of a number of experiments made by exposing various objects, such as a picture from a book, pieces of metal, keys, plants, etc., to the action of light, heat or electric currents, and then placing them over sensitive photographic plate in a dark room, leaving them there for 24 hours; in a number of cases reproductions were obtained. He believes these experiments indicate that the photographic action is due to the energy stored in the body and afterwards given off slowly, there being a difference in the power of absorption and radiation in various substances.

ELECTRO-CHEMISTRY AND BATTERIES.

Chemical Theory of Lead Accumulators. D. G. FITZGERALD. Lond. *Elec. Rev.*, July 31.—The beginning of an article criticising the one by Barnett, published in THE ELECTRICAL WORLD, April 11; he thinks that the gist of it appeared to have been contained in a paper by Wade, published in 1894, from which he quotes; he discusses the theory based on the occlusion of oxygen and hydrogen, showing that it rests on a very slight foundation of fact; he himself, in 1863, referred to a zinc and peroxide of lead cell which he explained without the use of the theory of occluded gas; he believes that Planté nowhere mentions the occluded gas theory, neither did Lodge; he also discusses the sulphating theory.

Celluloid in Accumulators. Lond. *Elec. Rev.*, July 31.—A correspondent states that he had considerable trouble with a large battery with celluloid forks and bearers, which were covered with a slimy black coating formed from that material; he asks others to publish their experiences.

Prize for an Accumulator. Electrochem. Zeit., August.—The Société Industrielle de Rouen (France) is offering a gold medal for an accumulator which has advantages over existing types. Models should be sent before the 30th of August to that society, 2 Rue Ampere, Rouen.

Transforming Emery into Corundum. Electrochem. Zeit., August; a brief abstract of an article in the *Elek. Anz.*, No. 50.—As only heat and not decomposition is required, an alternating instead of a direct current is used in the furnace; the electrodes are carbon rods; the emery is pulverized and mixed with carbon, the quantity depending on the iron present; the corundum obtained is almost free from water, while emery contains 5 per cent. of it.

Storage Battery Plate. HUEBNER. *Elec. Eng.*, Aug. 12.—The active material is made of a mixture of nitrate of hydro carbons, lead oxides and cellulose meal, which is fused and cast into plates without any supporting grid, giving a hard, porcelain-like product; plates having an area of 100 sq. cm. may be discharged with 30 to 40 amperes; no further information is given.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Frequency Teller. CAMPBELL. Lond. *Elec.*, July 31.—An illustrated description of a simple little portable instrument for the direct measurement of frequency. The principle depends on resonance; a steel reed is fastened near the middle, the long end being near the poles of an electromagnet through which the current passes; the short end is connected to a suitable gear by means of which it can be moved backward and forward in its support, thus changing the length of the free end, the amount by which it has been moved being indicated on a large, circular

dial by means of a suitable gearing; the length of the free end is varied until the reed is thrown into strong vibration, which takes place when the free end vibrates with a frequency double that of the current, and the resonance as indicated by a loud note being given out; the exact point of maximum resonance is observed more accurately by making it strike against an adjustible point when it reaches its greatest amplitude. The range of one of the instruments is from 40 to 150; the frequency is read off directly on the dial; it is easy to take readings to less than half a per cent.; the vibrator is not polarized and the note is therefore an octave higher, which is an advantage for lower frequencies and dispenses with permanent magnets or direct currents; some of them respond faintly at double the frequency and even for other multiples, which is thought to be due to the modifying of the wave form by the iron core of the magnet, and can be gotten rid of by inserting enough non-inductive resistance in the circuit of the magnet so as to diminish the effect of the inductance; the instruments will work with direct pulsating currents and can therefore be used as an accurate speed indicator, if a commutator is mounted on a shaft making and breaking a direct current. The *Phil. Mag.* for August reprints in full his Physical Society paper, which was abstracted in the *Digest*, June 20, describing this same device.

Determining Alternating-Current Curves. Behn-Eschenberg. *Elek. Zeit.*, July 30; a brief description of a modification of the *Drexler* system (see *Digest*, May 23 and July 18).—A suitable rotating disc of any convenient form, having a contact point, is revolved by means of a belt or other mechanical coupling, or by means of a motor, so that its speed differs very slightly from that of synchronism with the current to be measured, that is, there should be a very slight slipping; when driven by a belt this may readily be obtained by pasting paper on the pulley to bring the diameter to the required amount; an ordinary voltmeter is then used for measuring the voltage; the difference between the periods should be such that the oscillating character of the deflections of the voltmeter does not interfere with obtaining the readings and that the observer has time to read the deflections for a sufficient number of points on the curve. In an example which he gives there was time to take 40 observations of a period; only two minutes were required for a complete set of readings. He suggests the application of this method for measuring very small slippage, as for instance in the examination of non-synchronous motors.

Silk-Covered Wire Testing. Lond. *Elec. Rev.*, July 31.—A brief, illustrated description of the apparatus used by the Postal Telegraph department (presumably of England) for testing the conductivity of the copper and the thickness of the silk covering; in the apparatus a certain amount of wire is rolled off by means of a convenient apparatus and measured by a Wheatstone bridge; to measure the outside diameter a part of the wire is wound on a cone up to certain marks on the surface of the cone, which corresponds to ¼-inch spaces, the cone being turned by the hand and connected with a worm wheel from which the number of revolutions is read; a cone is used instead of a cylinder, in order that the wire may be closely wound without trouble.

Application of the Secohmmeter. Heinke. *Elek. Zeit.*, July 30.—The first half of a paper on the application of this instrument for determining dielectric constants and temperature coefficients of liquid insulators. The original form of this instrument of Ayrton and Perry is not well adapted for comparing capacities differing greatly from each other; the present article describes a modification to meet this.

Addition to the Wheatstone Bridge for the Determination of Low Resistances. Reeves. *Proc. Phys. Soc.*, July.—A reprint in full of the Physical Society paper noticed in the *Digest*, April 11, and mentioned May 23.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Railway Signals in Switzerland. Elek. Zeit., July 30.—An abstract of a recent descriptive article which was prepared for the exhibition in Geneva; it also covers telephony and the electric lighting of trains.

MISCELLANEOUS.

Preventing the Racing of Propellers. Lond. *Elec. Rev.*, July 31.—A brief description under the heading of Australian News, of an automatic safeguard to prevent the racing of the propeller of ocean steamers during rough weather. A solenoid is used to throttle the steam valve and is connected to a circuit from the dynamo, the current being controlled by the movements of the stern of the ship; on each side of the stern post is placed a narrow strip of copper connected with the circuit; when the stern is immersed to a proper depth the normal current passes, but when it is raised, the current is decreased, being cut off entirely when the screw is out of the water.

Physiological Phenomena. Weiss. *L'Eclairage Elec.*, July 11.—An abstract of a Physical Society paper describing two phenomena produced by the passage of a continuous current through organic tissue; he showed that the muscle of a frog generated an E. M. F. of polarization of about 0.2 volt; with larger muscles he showed that the polarization was slower but more intense and that it was nearly proportional to the length of the muscle and inversely to the section. He also showed that coloring material is carried in the direction of the current or in the opposite direction, according as the material is basic or acid; there is one substance which is an exception to this law.

Protection Against High-Voltage Shocks. Bozon. Lond. *Elec.*, July 24.—A suggestion for a safeguard for alternating-current employees; it consists of a flexible copper wire five feet long terminating in a pair of bracelets fastened to the wrists so as to make good metallic contact; the cord runs through the sleeves and at the back is attached to a branch wire which is connected to earth (the same idea was suggested a number of years ago).

International Congress of Electricians at Geneva. Lond. *Elec. Rev.*, July 31.—A publication of the programme.

Electrical Factories and Their Machinery. Lond. *Elec. Rev.*, July 31.—The beginning of a series of articles illustrating the various machine tools that are used in some of the principal electrical factories in England.

City and Guilds of London Technical Institute. Lond. *Elec. Rev.*, July 31.—A brief history of this institution.

Therapeutic Effects of High-Frequency Currents. D'Arsonval. *L'Ind. Elec.*, July 25; translated in full in the *Elec. Eng.* (New York), Aug. 12; an Academy paper.—High-frequency currents act powerfully to increase organic combustion, and he therefore thought that such currents might be used with good effect in cases of lack of nutrition, including certain diseases like sugary diabetes, gout, rheumatism, obesity, etc.; he therefore commenced a series of researches in this direction, which were begun in the early part of this year, and which so far have been very successful; the observations recorded refer to two cases of diabetes and one of obesity (but the results are not given); great care was taken to obtain very precise data; he used a Ruhmkorf coil in connection with accumulators; to avoid the usual trouble with a contact breaker he devised a simple and very effective means, consisting in revolving the platinum contact by means of a small motor, whose speed was geared down considerably; with this device the apparatus may be used for a long time without attention; the intensity of the current was regulated by using more or less turns of the solenoid, and it was measured by a hot wire direct reading galvanometer reading up to 500 milliamperes. There are three ways to apply these currents, the first is to pass them through the body directly by means of electrodes, the second is to place the body inside of a large solenoid, thus inducing the currents in the body itself, and the third is to make the body one of the armatures of a condenser which is charged statically by the solenoid; in the present tests the first method was used, the current being made to pass through the entire body from the feet to the hands; the current varied from 350 to 450 milliamperes; the applications were made daily, beginning with ten minutes' duration, which was gradually reduced; these currents are not felt by the patient. He discusses the reasons why such currents are not felt; physicists say that it is because their action is superficial, but the present author showed by means of a number of experiments that on the contrary the currents penetrate quite deeply; the superficial action would take place in good conductors like metals, but when the conductivity is as bad as that of the human body, namely, less than that of salt water containing 1 per cent. of salt, the same formulas show that the currents are practically uniform throughout the body. It is easy to verify this with a cylinder of salt water.

Organic Membranes as Insulators. Richardson. *Elec. Eng.*, Aug. 12.—A reprint of the article noticed in the *Digest* last week.

Bicycle Rider Killed by Lightning. West Elec., Aug. 15.—A report of a case that occurred in Chicago, Aug. 6, of a bicycler being instantly killed while riding, showing that the rubber tires cannot be relied upon as sufficient insulation; the tires were wet from the rain.

New Book.

The Magnetic Circuit in Theory and Practice. By Dr. H. Du Bois. Translated by Dr. Atkinson. Longmans, Green & Co., London, New York and Bombay, 1896. 362 pages, 94 illustrations. Price, $4.00.

It is seldom that one has the privilege of reviewing a work of such an admirable character as that of Dr. Du Bois on the Magnetic Circuit in Theory and Practice. Most students interested in magnetic research are familiar with this work as it originally appeared in the German. The translation by Dr. Atkinson will bring it into far greater prominence among English reading students, and will doubtless receive the highest commendation for the splendid literary style in which the translator has presented it.

The new volume as it comes before our notice demonstrates fully the necessity of the translator possessing a thorough and comprehensive knowledge of the subject treated by the author. This knowledge Dr. Atkinson seems to possess.

The whole work, which is divided into two parts, is by no means elementary in character, but on the contrary, demands on the part of the reader a knowledge of the literature bearing upon the investigations and principles pertaining to the magnetic circuit.

In the first part, the two introductory chapters are concise and still explicit, and form an opening wedge to the depths beyond. Commencing with Chapters III. and IV., each of which is based upon the treatise of Maxwell as followed out by Prof. Chrystal and MM. Mascart and Joubert,

a successful attempt has been made to elucidate upon the subject by graphical methods so that the reader is not left in obscurity as to the ideas the author wishes to present.

Chapter V. treats of the theory of closed and open ferro-magnetic circuits based on experimental tests of the iron toroid, standardization of the ballistic galvanometer, the tracing of the normal curve of magnetization, leakage coefficient, distribution of leakage, a comparison of theory and experiment, and an empirical formula for leakage.

Chapter VI., which begins Part II., discusses the general properties of the magnetic circuit.

Chapter VII. is a historical survey, and treats of the magnetic circuit by analogy, giving quite fully a history of early theories, commencing with that of Faraday and following with the theories of Maxwell, Lord Kelvin, Rowland, Bosanquet, W. von Siemens and the empirical rules of Kapp and Pisati. Then follows a brief theory of the modern conception of the magnetic circuit.

Chapter VIII. treats of the theory of magnetic circuits of dynamos and motors, and a predetermination of the total and the external characteristics. Then follow accounts of the investigations of Dr. Hopkinson, calculations of the various reluctances of the different parts of the circuit, calculation of armature reaction and experiments pertaining to the same, and the practical treatment of the arrangement of field magnets and field pieces, armature and interspace, and the change with multiple magnetic circuits and diagrams of the same.

Chapter IX. treats of the physical principle of various kinds of magnets and transformers, including a discussion of the dissipation of energy by hysteresis, retentivity, force of intensity, magnetic reluctance in joints, influence of variable self-induction, principle of released reluctance, principles of electromagnets for exerting different kinds of pull, principles of design, the old familiar transformer diagrams as determined by Ryan and Merritt, screening action of eddy currents, etc.

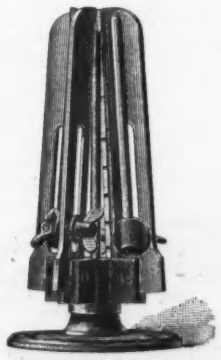
Chapter X. embraces the experimental determination of field intensity, including magneto-metric methods of Gauss, measurement of torque, ballistic galvanometer methods, magneto-optical methods, Hall's phenomenon, measurement of a field by bismuth spirals, and the principle of the magnetic-hydrostatic method as used by Quincke.

Chapter XI. treats of the experimental determination of magnetization or of induction, a discussion of Ewing's curve tracer, the methods of Koepsel and Kennelly, ballistic, isthmus and yoke methods, those devised by Drs. Hopkinson and Gray, magneto-optical methods, Kerr's phenomenon, fraction methods and magnetic-hydrostatic methods.

The student will find this treatise a most valuable adjunct to the study of electro-magnetism.

Direct-Current Arc Lamp.

The General Incandescent Arc Light Company, New York, is putting out some handsome designs of its long-life direct-current arc lamps.



WIRE REEL.

ARC LAMP.

These lamps are very attractive and ornamental in appearance. The feeding machanism is simple and reliable, and no springs or gear-wheels are used. The regulation is close and the adjustment cannot change. Trimming can be done easily and every part can be removed without disturbing the others.

These lamps burn singly on 100 to 125 volt direct-current circuits, and one pair of carbons lasts 150 hours.

Wire Reel.

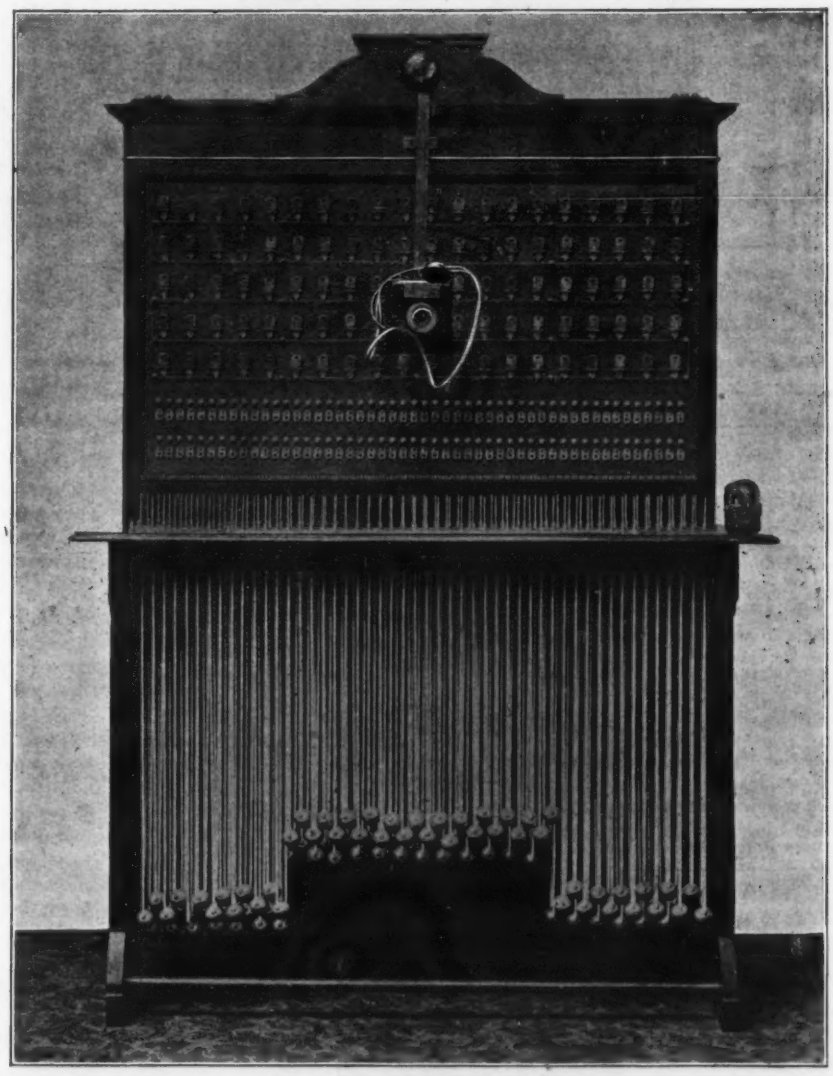
A handy device for counter or store use is shown in the accompanying illustration. It is called the "Perfection" wire reel by the manufacturers, Messrs. J. Jones & Son, New York City.

The reel is made adjustable to accommodate spools of annunciator wire and coils of wire or cord of any diameter. It is made entirely of iron, is very compact and works easily and noiselessly. This reel, in combination with the firm's wire winder and wire measurer, makes a very complete and useful set. It is light, strong, adjustable and cheap. The illustration shows the reel folded.

Improved Telephone Switchboard.

The accompanying illustration represents an improved central telephone station switchboard, invented by Mr. Edward L. French, superintendent of the Missouri Telephone Manufacturing Company, St. Louis, Mo. The most striking feature of the board is the large number of plug cords. Each subscriber has a drop, and the continuation of the drop to complete its circuit has a plug cord. The base of each plug is a brass button, which is pulled down tight to brass bars running across the switchboard table, and by the aid of the lead balls, which have a hole through them, threaded on a spiral-braided plug cord, the current travels its course to the ground. This feature, in having one plug cord for each subscriber, is claimed to be an important one and an improvement. Each plug is numbered, and the operator with a little experience can familiarize herself, and quickly lay her hand on any plug desired.

When a subscriber desires a connection the operator takes the plug



TELEPHONE SWITCHBOARD.

corresponding to the drop and touches it to the operator's bar, which is a long brass bar running the full length of the table of the switchboard. This throws her receiver and transmitter in circuit with the subscriber, and she finds the number desired; then by simply inserting the plug in the plug-hole of the number called for the connection is made.

When the plug is inserted it cuts out the drop coil of the subscriber and leaves only one coil cut in on the line between the two subscribers

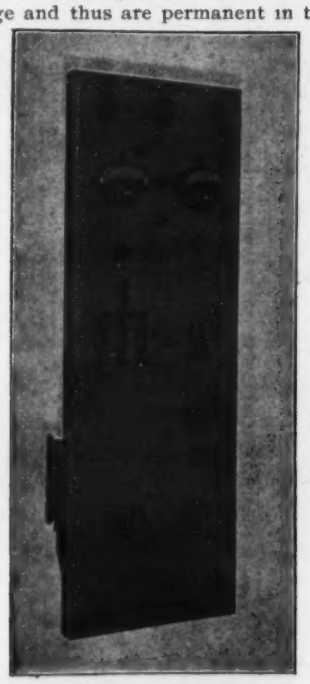
conversing. This coil is wound with very low resistance and serves as a cleaning out coil when the two subscribers are through talking.

The jacks used in connection with this board are extremely simple. The plug breaks the connection from the drop to the plug cord. The plug-holes, which are on the face of the board, are all shunts, and when any plug is inserted in any plug-hole it has a direct connection to the line without going through any coil. Another important feature is the easy adjustment of this board. Mr. French claims that he can place a 200-drop switchboard in a space 6 feet wide and leave plenty of room for renewals and adjustment.

This board is said to possess other mechanical and electrical improvements, which render it very efficient for quick and accurate service. It is well finished and contains every improvement. All the metal parts are nickel plated and the wood is highly polished.

Alternating Current Instruments.

The accompanying illustration represents the inclined coil type of measuring instrument as developed by Prof. Thomson and adapted to the use of switchboards. A complete series of these instruments is now being manufactured by the General Electric Company. They combine, with accuracy and durability, a long scale and a mechanical character requisite in modern switchboard practice. The instruments are free from parts liable to change and thus are permanent in their readings. The



Switchboard Panel.

same calibration is accurate for all commercial frequencies. Each instrument is constructed for either back or front connection, is fitted with a nickel cover and binding post and a black enameled base. The ammeters read from 0 to 3½, 10, 25, 35, 50, 75, 100, 150 and 200 amperes; the voltmeters from 0 to 75, 150 and 650 volts.

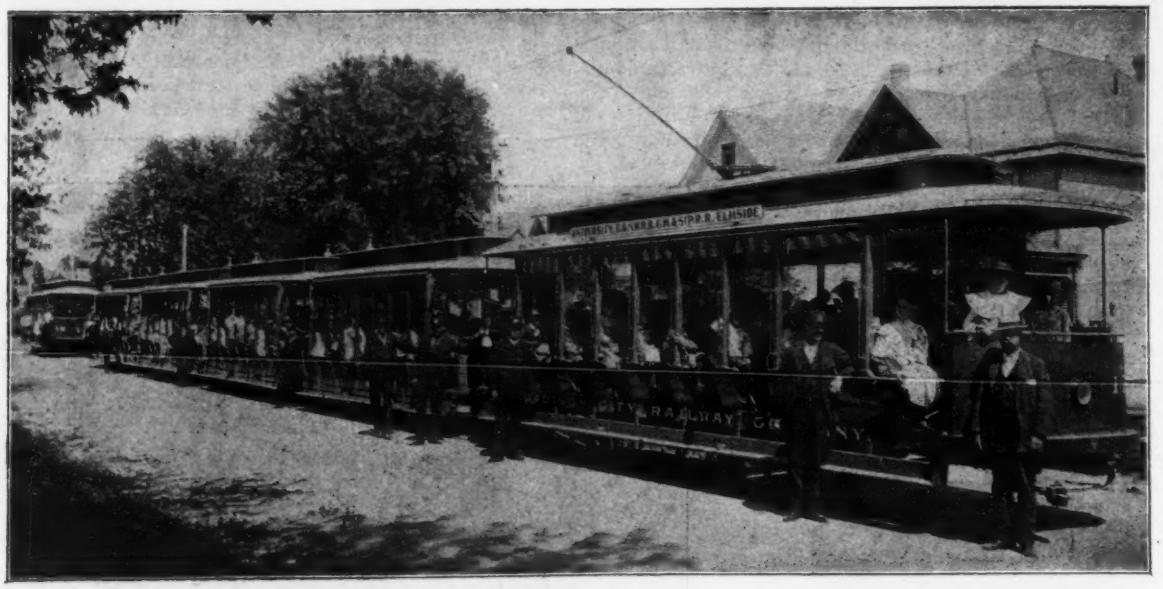
Röntgen-Ray Apparatus.

Investigators and others practically interested in Röntgen-ray work will without doubt be greatly interested in noting the appearance of the General Electric Company as manufacturer of all kinds of Röntgen-ray apparatus. As will be seen in our advertising columns, the Edison Decorative and Miniature Lamp Department (General Electric Co.), Harrison, N. J., is in the field with an entire line of Röntgen-ray apparatus of all kinds. The name of this concern is a guarantee of the completeness and efficiency of any apparatus that it may put out.

We hope to be able to present to our readers shortly some further description of the apparatus which is now being made and extensively sold by the above concern.

A Heavy Train.

Electric railway motors occasionally act in a peculiar manner and submit to overloads without apparent reason, yet performing their duties without hesitation. The accompanying illustration represents a case of this kind, brought to our notice by the receiver of the Madison City Railway Company, Mr. F. W. Oakley. The motor car, equipped with two G. E.-800 motors, was overloaded to a considerable degree, as may be judged from the illustration. The load consisted of the motor-car and



A Heavy Train.

four trailers, containing in all about 500 persons. With this load a speed of seven miles an hour was maintained and the heaviest grades along the road were mounted without difficulty. This speaks well for the motors to stand up against such an apparent abnormal strain.

Compression Shaft Coupling.

The two illustrations herewith represent the Shaw patent compression shaft-coupling, for which Patterson, Gottfried & Hunter, Limited, New York, are the agents.

Fig. 1 shows the coupling fitted to a shaft; Fig. 2 represents the outer shell and sleeve. The sleeve is tapered from the middle down to each end and has six slots running nearly its entire length, three from one end and three from the other, alternately. It holds the ends of the shafts by compression. The outer shell has a bore tapering from the middle, the taper corresponding with that of the sleeve. It is divided in two parts, the halves being drawn together by four bolts and nuts. In bringing the halves together the compression causes the sleeve to grip the shaft. In taking the coupling apart after the nuts are taken off the bolts the half of

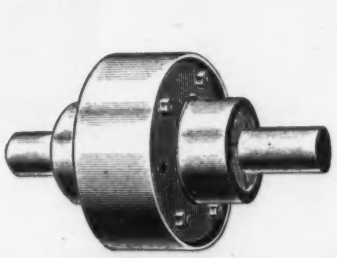


Fig. 1.

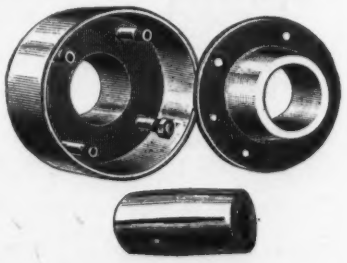


Fig. 2.

the shell can be easily separated by driving a pin through the pin holes. The advantages possessed by this form of coupling are that it does away with keys; shafts need not be centred even if there be a slight variation in diameters and a gripping power is obtained that will brake a shaft before slippage takes place.

NEWS OF THE WEEK

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, Aug. 15, 1896.

ELECTRICS.—General Electric stock was steadier during the past week, resulting in a net gain in price of 2 at the close on Saturday. The number of shares that changed hands amounted to 12,072, the highest price of the week being 24⅜, and the lowest 21½, closing at 23¾. In Boston 1 per cent. was paid on Saturday to call 400 shares of General Electric at 30 for 60 days. Little is heard of Westinghouse stock here, the last recorded quotation on the common shares being 24½ bid. The quotation for the preferred is unchanged.

TRACTIONS.—Street railway securities were very inactive during the past week. Practically no stock has changed hands and prices have in some instances receded slightly on light offerings. The report of the Brooklyn Heights Railroad Company, which is a very favorable one, had a strengthening effect on Brooklyn City stock. After being offered down to 153 without sales, it rallied toward the close to around 157, at which figure some sales were made.

TELEGRAPHS AND TELEPHONE.—In common with the general better feeling Western Union Telegraph shows an improvement, having recovered about all of the loss recorded during the previous weeks. There was an active market, no less than 63,668 shares having changed hands, with steadily increasing prices. The lowest quotation of the week was 72¾ and the highest 78⅜, closing at 78⅛—a net gain of 4⅜. Postal Telegraph remains unchanged as to quotations. Bell Telephone recovered only one point of the four lost the previous week, the Boston market being steady to firm. On Friday American cable stock dropped 7 per cent. on the sale of 200 shares. It had been offered at 86 for a long time without any bid. The decline of five points in Erie telephone stock during the past week could not be explained by the Erie Telephone people. They claim that the earnings of the sub-companies continue good, and that new construction work is going on as usual.

ELECTRICAL STOCKS.	Par.	Bid.	Asked.
Chicago Edison Company	100	..	..
Edison Electric Ill., New York	100	90	93
" " " Brooklyn	100	..	..
" " " Boston	100	..	..
" " " Philadelphia	100	..	..
Edison Ore Milling	100	13	15
Electric Storage Co., Philadelphia	100	22	22¼
Electric Storage, pref	100	24	24½
General Electric	100	23½	23¾
General Electric, pref	100	71	73
Westinghouse Consolidated, com	50	24½	26
" " pref	50	49	50
BONDS.			
Edison Electric Ill., New York	105	109	..
Edison Electric Light of Europe	100	75	85
General Electric Co., deb. 5s	100	85	..
TELEGRAPH AND TELEPHONE.			
American Bell Telephone	100	196	198
American District Telegraph	100	*29	39
American Telegraph & Cable	100	..	89
Central & South American Telegraph	100	124	127
Commercial Cables	100	125	..
Erie Telephone	100	51¾	56
New England Telephone	100	90	..
Postal Telegraph-Cable	100	70	75
Western Union Telegraph	100	78	78⅛
ELECTRIC TRACTION STOCKS.			
Baltimore Traction	25	15⅝	16
Brooklyn Rapid Transit		19	20
Brooklyn Traction	100	..	14
" " pref	100	46	48
Buffalo St. Ry	100	58	63
Cleveland Electric Ry	100	..	..
Columbus St. Ry	100	37	40
Hestonville	100	45¾	46
" pref		..	62½
New Orleans Traction	100	7	10
" " pref	100	45	55
North Shore Traction	100	16	22
" " pref	100	55	65
Rochester St. Ry	..	15	20
Steinway Ry	..	45	50
Union Railway (Huckleberry)		98	105
Union Traction, rcts $10 pd	..	12¾	13
West End, Boston	100	64½	65
" " pref	100	85	..
Worcester Traction	100	13	16
" " pref	100	80	88
BONDS.			
Brooklyn Rapid Transit 5s. 1945	100	70½	..
Buffalo St. Ry. 1st con. 5s	100	..	*103
Cleveland Elec. Ry. 1st mtge 5s	100	100	*103
*Columbus St. Ry. 1st 5s	100	87	*93
Rochester St. Ry. 1st 5s	100	..	98
Union Railway (Huckleberry) 1st mtge 5s		102½	105
*Westchester Electric 1st mtge 5s	100	100	102

* With accrued interest.

EARNINGS.—The report of the Edison Electric Illuminating Company, of New York, for July, shows gross earnings of $156,891.32, an increase of $21,197.73 as compared with the same month last year; the net earnings were $67,270.56, an increase of $8,736.97 as compared with the previous July. The gross earnings for the seven months ended July were $1,262,795.96, an increase of $111,154.18 as compared with the corresponding seven months of the year previous, and the net earnings for the same period were $611,803.55, an increase of $62,267.64 over the same period in 1895.

The New Orleans Traction Company's earnings during July, 1896, were $114,079, a decrease of $2,417 as compared with the same month last year.

The Bridgeport Traction Company's earnings for July were $35,741, showing an increase of $3,843 as compared with July, 1895.

The North Shore Traction Company reports earnings for July, 1896, of $172,127, an increase of $620 as compared with the same period in 1895.

The Columbus (Ohio) Street Railway Company reports gross earnings in July, 1896, of $56,112, an increase of $214 over the gross earnings in July, 1895. The expenses were $26,197, a decrease of $1,320; net earnings, $29,914, an increase of $1,534.

The Brooklyn Heights Railway Company reports gross earnings for the year ended June 31, 1896, of $4,272,392, and net earnings of $1,769,166, an increase respectively of $220,203 and $576,783, as compared with the year ended June 30, 1895. The deficit of the previous year was offset by $619,497.

DIVIDEND.—The Pittsfield, Mass., Electric Light Company has declared a regular annual dividend of 6 per cent. It is stated that the company will increase its capital stock to $125,000.

THE EDISON ELECTRIC ILLUMINATING COMPANY, of Brooklyn, reports gross earnings for July of $59,018, an increase of $9918 as compared with the same month of last year, and net, $24.138, an increase of $5432. For the seven months ending July 31 the gross earnings were $462,430, an increase of $161,608 as compared with the corresponding period of last year, and net, $205,274, an increase of $78,719.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, August 17, 1896.

MR. W. L. STRAUSS, New York, has just returned from Europe, where he secured the agency for the United States of an incandescent lamp said to be of the highest grade, and manufactured by one of the largest electrical concerns at Budapest, Hungary. Mr. Strauss is now prepared to fill orders and compete with the manufacturers of this country.

MR. H. M. MONTGOMERY, for some time associated with the Goubert Manufacturing Company, New York City, and previous to that for several years associated with the Babcock & Wilcox Company, has gone with Thayer & Co., Inc., Boston, New York City and Philadelphia, to be located in their New York office, in the selling department of Cahall and Babcock & Wilcox boilers, manufactured by the Aultman & Taylor Machinery Company, Mansfield, O.

A NEW FIRM.—Messrs. John D. Miller and Edwin H. Ludeman have severed their connection with the Pierce & Miller Engineering Company, and formed a co-partnership under the firm name of J. D. Miller & Co. The new firm's offices are in the Taylor Building, 39-41 Cortlandt Street, and the business will be that of contracting for power plants, engines, boilers and general machinery. The firm will also handle contractors' supplies and make plans, specifications and estimates on work in its line of business.

ELECTRICAL PLANT DESTROYED BY FIRE.—On the afternoon of Aug. 11 fire destroyed the building at 465 Greenwich Street, in which were located the works of A. K. Warren & Co. The interior of the building was completely destroyed, and the firm lost its entire plant. A. K. Warren & Co. occupied the first, fourth, fifth and sixth floors of the building, the second and third floors being taken up by other manufacturing concerns. They employed about 60 persons, two of whom were burned to death, and several others more or less injured and burned. The unfortunate victims were William Gray, the firm's foreman, aged 34, and James Muller, aged 35, who was employed as a machinist. Seven of A. K. Warren & Co.'s employees were injured, only one, however, being so badly hurt as to cause any apprehension as to his ultimate recovery. This one is John Cummings, aged 16, who was an apprentice. He jumped from a second story window and thereby received serious injuries. The injuries received by the unfortunate men were mainly burns. A. K. Warren & Co.'s losses, which amounted to $25,000, are partially covered by insurance. The fire is supposed to have originated by the friction of the power belt against the wooden ceiling in the engine room. We are informed by the firm that they have opened temporary quarters at 20 Desbrosses Street, in the same building, where they will carry on their business as heretofore. They have made arrangements which will enable them to undertake any work in their line and give it prompt attention. They are now in good running order.

Western Notes.

Branch Office of THE ELECTRICAL WORLD,
936 Monadnock Building,
CHICAGO, Ill., Aug. 14, 1896.

THE ELECTRIC APPLIANCE COMPANY has been somewhat delayed in getting in its stock of "Electra" high grade Nuernberg carbons, but has finally received the first carload, and is now ready to talk imported carbons to the Western trade. The company will carry the largest stock of imported carbons in the West.

LIGHT IN THE POST OFFICE.—The electric lighting system of the General Post Office, Chicago, is about to be changed. A practical test has demonstrated that the incandescent lamp close to the desk of the clerk is far better than the arc light. Most of the arc lamps will be removed to make place for the others. The change will cost $5000.

J. HOLT GATES has been appointed Western sales agent of the Walker Company, Cleveland, O. Mr. Gates is also Western sales agent of the C. & C. Electric Company, New York, and in his salesroom at 311 Dearborn Street he carries a full line of dynamos and motors, enabling him to make prompt shipments. With the Walker and C. & C. Companies' agencies, most any requirement can be filled immediately.

RESIGNED.—Mr. F. B. Cook has resigned the position of chief engineer of the Central Union Telephone Company after 17 years' connection with that corporation. During this time he has filled probably every technical position in the company's service. Mr. Cook's experience in the telephone field has been of a wide scope, and many of the telephonic labor-saving devices in use in the United States to-day are of his production. Mr. Cook is succeeded by Mr. S. G. McMeen.

THE ELECTRICAL MAINTENANCE COMPANY, 50 Broadway, New York, having met with great success, in New York and Philadelphia, has decided to open a Chicago office, and has been fortunate in securing the services of Messrs. W. R. Mason and William Sharpe as agents. The plan of the company is to give expert advice on electrical matters, and to maintain electrical machinery at its highest efficiency, replacing burned-out armatures, field coils, commutators and brushes under contract for a small annual charge. Messrs. Mason & Sharpe can be found at 1202 Fisher Building, Chicago.

English Notes.

(From Our Own Correspondent.)

LONDON, Aug. 5, 1896.

ISLE OF MAN ELECTRIC RAILWAYS.—The Isle of Man folks do not appear to be contented with the three electric railways and two "toy" steam railways with which their little kingdom is blessed. One would have supposed these to be a fair allowance for an island not 30 miles long, nor more than 13 broad; but, like Oliver Twist, the Manxmen are asking for more, and there is a rumor that the next electric railway in the island will open up direct communication between Ramsey and Douglas, by means of a branch from the existing Douglas-Laxey line.

THE NATIONAL TELEPHONE COMPANY.—Notwithstanding the animadversions of a large section of the public, and the purchase by the Government of its interurban wires, our great telephonic monopoly appears to be doing remarkably well from a financial standpoint. With a capital of about four and one-half million sterling, its income last half year was £430,000 and after paying £226,000 for working expenses, £39,000 to the Post Office in royalties, and transferring £35,000 to the revenue fund, there was a sufficient sum in hand to pay 5 per cent. upon its ordinary very-much-watered capital.

RECTIFIERS.—Power station engineers who have to run their stations on a composite load, consisting of public arc lamps and a general supply, are paying serious attention to a comparatively new solution of the problem, viz., the use of alternate-current rectifiers for the arc lamp circuits, and a combination of the two loads on the same alternators. Rectifiers, of a type designed by Mr. S. Z. de Ferranti, have been running for about two years at Portsmouth, where the street lighting is generally admitted to be unsurpassed. I understand that the engineer at Portsmouth regards them as an unqualified success, both from the point of view of station management, and as regards the good working of the lamps. Mr. Hesketh, late engineer at Blackpool, also gave them a tria., and in a paper which he read at the last session of the Northern Society of Electrical Engineers he regards them as being by far the best solution of the problem of public arc lighting. Rectifiers have also been installed at the new electric supply station at Islington, but have not yet been running long enough for their value to be judged from this particular instance.

LIVERPOOL OVERHEAD ELECTRIC RAILWAY.—The accounts for the first half of the year of the Liverpool Overhead Railway have just reached me, and I am glad to say that this well-managed line is maintaining the success which has attended it from the very beginning. During the half year mentioned the 38 coaches have run a total of 313,010 train miles, each train being composed of two coaches and capable of carrying 112 passengers. A total of 3,739,575 passengers have been carried. An examination of the accounts shows that the revenue per train-mile has been 23.9d., while the total expenditure out of revenue has not exceeded 15.1d., leaving a clear profit of 8.8d. per train mile. With this profit a dividend of 5 per cent. on the preference shares and 2¾ per cent. on the ordinary shares has been paid. The expenditure in connection with the power-house has amounted to 3.39d. per train-mile, out of which about one-halfpenny per train-mile has been paid for fuel. The power-house is run entirely by steam, raised in automatically-stoked Lancashire boilers, the engines being of a horizontal low-speed Corliss type, rope-geared to the railway generators.

ELECTRICAL FINANCING.—For some years past a small but exceedingly well-managed concern known as the Electric & General Investment Company, has been engaged, with handsome profit to itself and no little advantage to others, in financing electrical undertakings in this country. The 20 per cent. dividends of this company have at last given rise to competition and the public is now invited to apply for shares in "The Electrical Development & Finance Corporation (Limited)" which proposes to start business under the ægis of a Duke, a chemist and an electrical manufacturer, and with a capital of £500,000. This venture has for its primary object "the promotion and development of undertakings for utilizing electrical powers in all its industrial applications," and a considerable revenue is anticipated from the promotion and development of electric railway undertakings. The corporation has four jobs immediately to hand, one of which is mysteriously described as "the electric lighting of an important and rapidly growing district." With money "a drug in the market," it is a little difficult to see the *raison d'être* of this financing institution; we have banks and capitalists enough to lend any required sum upon decent security.

BELFAST GAS-ENGINE ELECTRIC SUPPLY-STATION.—Owing to the rapidly increasing demand for electric light in Belfast, the little gas-engine electric supply station is threatened with overwork before the new and larger steam-driven station can be built. It seems urgent that the station should at once be equipped with additional plant; but the electric light committee of the Belfast corporation seems to have had enough of gas engines, and is reluctant to put any money into any more. What is the precise reason for the antipathy to gas engines, which this committee has recently so loudly professed, is more than a plain man outside the committee can fathom. It has been suggested that any very considerable increase in the load on the gas works would necessitate extensions there, and it is just possible that this is what the authorities are anxious to avoid. As to the working of this interesting little gas-engine station, although it is not perhaps of the best, it is far from being unsatisfactory. Gas fuel has only cost 1.45d. per kilowatt-hour sold, but the chairman of the electric light committee believes that if they had had a steam-driven station, fuel would not have cost more than one-third of this amount. Very few steam-driven stations, however, work at ½d. per kilowatt-hour for fuel.

General News.

Legal Note.

JUDGE EDWARD T. GREEN, of the United States Court for New Jersey District, on Aug. 11, in Trenton, N. J., granted a temporary injunction restraining the Walker Company and Charles N. King, of Jersey City and Cleveland, from making, using, or causing to be made or used a certain improvement in suspended switches and traveling contact for electric railways, covered by patent No. 495,443, issued to the administrator of Charles J. Van Depoele and now owned by the Thomson-Houston Electric Company, the complainant in the suit.

New Incorporations.

THE SOUTH BEND ELECTRIC COMPANY, South Bend, Ind., has been incorporated with a capital stock of $150,000.

THE OLIVE BRANCH ELECTRIC LIGHT COMPANY, Ferguson, Mo., has been organized, with a capital of $50,000. The incorporators are George W. Downs, John F. Ashbrook and Olive F. Downs.

THE MIDLAND ELECTRIC COMPANY, of New York City, has been incorporated by M. J. Power, J. B Campbell and Paul Halpin, of New York City, to deal in electrical apparatus. Capital stock, $10,000.

THE STANDARD TELEPHONE COMPANY, of Baltimore, Md., has been organized with a capital stock of $15,000 The incorporators are: Thomas S. Hodson, Charles O. Cooper, Edward S. Kines, and others.

THE PEOPLE'S ELECTRIC LIGHT, HEAT & POWER COMPANY, Salina, Kan., has been incorporated with a capital stock of $75,000 by W. B. Nickels, William Tracy, William C. Hook, Ford F. Harry and David Benjamin.

THE HOUSTON ELECTRIC STREET RAILWAY COMPANY has been organized in Houston, Tex., with a capital stock of $2,000,000. Incorporators, Albert N. Parlin, George E. Smith, of Boston, and T. W. House, of Houston, Tex.

THE KALAMAZOO HEAT, LIGHT & POWER COMPANY, of Kalamazoo, Mich., has been organized with a capital of $200 000. The incorporators are: E. B. Caldwell, Chicago; George W. Miller and Homer Manvel, of Kalamazoo.

THE COMMERCIAL SUPPLY COMPANY, Detroit, Mich., has been formed for the purpose of manufacturing and selling electrical appliances. The incorporators are Perry E. Phillips, A. A. Robinson, and George L. Robinson, Detroit, Mich.

THE PORTABLE ELECTRIC ASSISTANT COMPANY, Westbrook, Me., has been incorporated with a capital stock of $100,000. The promoters are: Willard E. Dow, George Warren Wheeler, Braintree, Mass., and Frank E. Webb, Westbrook, Me.

THE STOCKTON & SAN FRANCISCO ELECTRIC POWER COMPANY, Fresno, Cal., has been incorporated by Lester E. Walker, J. C. Shepard, Charles C. Bonner, Fresno, Cal., and Sig. Wormser and F. Youngren, Kingsburg, Cal. Capital stock. $5,000,000.

THE HOUSTON ELECTRIC STREET RAILWAY COMPANY has been organized in Houston, Tex., with a capital stock of $2000. The directors are Albert N. Partin, George E. Smith, of Boston; T. W. House, of Cleveland; H. C. Chase and E. P. Hill, of Houston.

THE NEWCASTLE & MAHONINGTOWN STREET RAILWAY COMPANY has been incorporated in Harrisburg, Pa. De Witt Dilworth, of Newcastle, is president, and Joseph W. Bradley and Wm. Cummins, of the same place, are also interested. The capital stock is $12,000.

THE PROVIDENT ELECTRIC LIGHT & POWER COMPANY has been organized in Camden, N. J., with a capital stock of $50,000. The incorporators are: David Peoples, Aaron J. Stull, Elisha W. Maloney, Samuel Peoples, of Philadelphia, and Herman Rosade, of Camden.

THE IMPERIAL ELECTRIC COMPANY, of Westfield, N. J., has been organized with a capital of $60,000, for the purpose of manufacturing electrical apparatus and supplies. The incorporators are: J. W. Eskhorn and W. B. Elliott, of Westfield, and J. J. Linder, of Brooklyn.

THE COLEMAN CALL & SIGNAL COMPANY has been organized in New York City with a capital stock of $3,000, to maintain and operate electrical wires for signal and call purposes. The incorporators are Daniel Coleman, John Coleman and Daniel Coleman, Jr., all of New York City.

THE BERKLEY ELECTRIC LIGHT & POWER COMPANY has been incorporated in Norfolk, Va., with a capital stock of $50,000, to engage in the electric light and power business. The incorporators are E. N. Tilley, H. J. Palmer, Benjamin Tilley, J. J. Ottley, Samuel B. Mend, all of Norfo lk.

THE NEW HAVEN SYNDICATE COMPANY, New Haven, Conn., has been incorporated in West Virginia to construct, operate and equip electric, steam and other railways. Incorporators: E. W. Decker, New Haven, Conn.; Guy L. Fairbrother and Israel A. Kelsey, of West Haven, and S. Harrison Wagner, New Haven. Capital stock, $25,000.

THE ALASKA ELECTRIC LIGHT & POWER COMPANY, Juneau, Alaska, has been incorporated in Oregon with a capital stock of $100,000, for the purpose of doing a general electric light and power business in the towns of Juneau and Douglas, Alaska. Those interested are Robert Duncan, Jr., J. P, Corbus, A. W. Corbus and John F. Maloney, all of Juneau.

THE KEYSTONE TELEPHONE & TELEGRAPH COMPANY has been organized at Norristown, Pa., to build and maintain telephone and telegraph lines in the counties of Montgomery, Chester, Bucks, Berks, Philadelphia and Delaware. Capital, $15,000. Directors, Joseph C. Landes, A. H. Tyson, E. A. Krusen, Collegeville; Isaiah C. Landes, Yerkes; F. G. Hobson, Norristown.

TELEGRAPH AND TELEPHONE.

CASCADE, IA.—The Central Union Telephone Company will establish an exchange in this place.

RINGWOOD, ILL.—Mr. Joslyn, of Woodstock, will establish a telephone exchange here if satisfactory arrangements can be made.

HALLETTSVILLE, TEX.—The City Council has granted a franchise to the Southwestern Tel egraph & Telephone Company to operate its system in this place.

EDWARDSVILLE, ILL.—A franchise has been granted to the Union Telephone Company, of St. Louis, to construct and operate a telephone system in this place.

MUSKEGON, MICH.—The Citizens' Telephone Company has been granted a franchise in this place and will supply 'phones at $18 and $24 for residence and business uses.

STANTON, MICH.—A telephone company has been organized in this place by W. P. Gamber, A. N. Entrican, P. J. Devine, C. W. French, B. S. Swarthout, J. N. Crusoe and T. S. Earle.

BARRON SHIELD, WIS.—The Barron County Telephone Company has bought the franchise for Rice Lake and will at once proceed to establish exchanges in Rice Lake and Cumberland.

CHATTANOOGA, TENN.—J. C. Duncan, general manager of the People's Telephone Company, Knoxville, Tenn., has filed an application for a charter to establish a telephone exchange in this city.

WEST POINT, MISS.—The West Point telephone exchange has been sold to the new telephone company recently organized in this place. The new company will remodel and extend the present system.

UNION CITY, IND.—Union City, Ind., and Winchester, Ind., are to have a telephone plant soon. Fockler Bros. have bought all the material and supplies, and will soon have both exchanges in operation.

HUNTINGTON, W. VA.—Cooper & Johnson, of Wayne, W. Va., have secured the contract to build a new telephone line from this place to East Lynn, a distance of 30 miles. The line will be completed by Nov. 1.

FLINT, MICH.—J. H. McFarlan is organizing a company to put a telephone line in from this city to Fenton and Linden, connecting with the independent line at Swartz Creek and with the new company's line at Fenton, and having the line run through Rankin.

NEW HAVEN, CONN.—Papers have been served on the Philadelphia, Reading & New England Railway in an injunction suit brought by the Winsted Telephone Company, restraining the railway from taking the telephone from the Winsted station. The Southern New England Telephone Company claims the exclusive right to place telephones in the stations.

CINCINNATI, O.—Sealed proposals will be received by the Board of Fire Trustees of the City of Cincinnati until Sept. 10, for the manufacture, delivery and installation of an underground cable for the electric circuits for the fire department, according to plans and specifications now on file in the office of Thos. F. Clohesey, electrical engineer, Pike Building. D. W. Shedd is secretary.

ELECTRIC LIGHT AND POWER.

MAGNOLIA, MISS.—The Magnolia Gin & Light Company wants bids on electric light machinery.

NEGAUNEE, MICH.—It is probable that a municipal electric light plant will be established in this place.

HUTCHISON, MICH.—F. Hughes is negotiating for the establishing of an electric light plant in this place.

MANCHESTER, VA.—It is reported that an electric light plant will be established here in the near future.

ALBANY, N. Y.—The Common Council will be asked to place electric lights along the roadway of the Northern Boulevard.

GEORGETOWN, MASS.—An effort is being made to interest the people of this place in favor of establishing an electric light plant.

BEN AVON, PA.—William Jackson and D. M. Sloane have been granted a franchise to establish an electric light plant in this place.

VIRGINIA, ILL.—Virginia will have an election to decide whether or not the village shall appropriate $600 for electric street lights.

COON RAPIDS, IA.—The Town Council has granted an electric light franchise to Messrs. Wilson & Taylor, of this place, for a term of 15 years.

KINGSTON, N. C.—At an election in this place on the question of issuing electric light bonds for a plant here, the proposition was carried by a large majority.

BLOOMINGTON, ILL.—The City Council has passed an ordinance providing for an inspector of electric wires and poles, who shall also regulate electric installation.

BUFFALO, N. Y.—It is stated that the electrical energy to be brought here from Niagara Falls will be delivered to customers at $36 per horsepower per year.

BRYAN, O.—A special election was held for the purpose of voting on the question of issuing bonds to buy a plant for lighting the town. The proposition was carried.

BEMENT, ILL.—The Electric Light Company will build a new powerhouse and install new engine and boiler, the plans and specifications of which are now in the hands of the company.

GENEVA, ILL.—The contractors for the water plant at Geneva offer to install an electric plant there for $13,000, taking city scrip in payment, as the town is already bonded to the legal limit.

SALEM, MASS.—The electric lighting company has contracted to supply the city with 170 arc lights, until Dec. 31 next, at $140 each per year, and 600 incandescents of 300 candle-power each, at $22.25 per year.

NEWARK, N. J.—An application from the Consumers Electric Light Company has been made to the Board of Works for a franchise to use the streets and furnish public and private consumers with light and power.

CHATFIELD, MINN.—The Council decided to grant to C. P. Madison a 20-year electric light franchise, the city to have option of purchasing at the end of 10 years. The plant will be in operation by Jan. 1. It will be run by water at Madison's mill.

KANKAKEE, ILL.—J. B. Abbot, of Mason City, Ill., has purchased the Kankakee flouring mill and water-power plant, with the intention of establishing an electric plant to light the city and run the street railway. He put in $25,000 in improvements.

WEST NEWTON, PA.—At the regular meeting of Council an ordinance was passed calling for a special election to decide whether or not $14,500 6 per cent. bonds shall be issued for the purpose of removing and enlarging the electric light plant.

POMONA, CAL.—The San Antonio Electric Company is putting in a large steam plant near the Hotel Palomares, in order to ensure a supply of power during dry seasons. The company's water-power in the San Antonio canon has proved to be unreliable.

EMPORIA, KAN., is ready to receive propositions for the putting in of an electric light plant that will furnish not less than 75 all-night lights for the streets on a contract for a definite number of years at a less rate than $9,000 per month. N. S. Alexander is City Clerk.

SAN JOSE, CAL.—War has been declared by the Town Trustees of Santa Clara upon the Electric Improvement Company of this city, and as a result the electric lights have been discarded and the streets will be lighted with lamps until the town can own its own lighting plant.

ESCANABA, MICH.—The Board of Public Works is advertising for sealed proposals until Aug. 29 for one 1000-light alternating-current dynamo with necessary appurtenances for the city electric light plant. Mr. Henry Wilte, clerk of the Board, will receive the bids and give any further desired information.

XENIA, O.—Sealed proposals will be received, Sept. 1, by the trustees of the Ohio Soldiers' & Sailors' Orphans' Home at Xenia, for the furnishing, construction and operation of an electric light plant, in accordance with plans and specifications proposed therefor. Address David Lanning, superintendent, Xenia, O., for further information.

ORANGE, N. J.—The Excelsior Electric Company, Newark, N. J., will probably receive the contract for lighting the streets of this city. The committee has recommended to the Common Council that this action be taken. It is stated that the contract will be transferred to the People's Light & Power Company, the holder of the present contract. The latter company will build a new power plant.

ST. LOUIS, MO.—The Board of Public Improvements has notified the electric light company that unless satisfactory steps were taken by Aug. 4, the city would proceed to restore the electric lights on streets within the tornado district, doing the work at the expense of the companies. From a statement made by the Lighting Department it appears that 460 arc lights in the tornado district have not yet been restored.

HEMPSTEAD, L. I.—The alleged ghost of the former president of the Hempstead Gas Light Company, who was murdered last March, is causing much trouble around the company's electric plant. Several accidents and break-downs at the plant are attributed to the spirit. Whenever it appears, the dynamos groan and the armatures burn out. It also casts an evil spell on the switchboard, and whenever it is around there the lights go out. The superintendent of the station abandoned his position because the ghost insisted on running the place.

HALIFAX CARNIVAL.—At the Halifax Carnival, just closed, one of the principal attractions was the electrical illuminations of the warships and the

illuminated procession in the harbor of steamers, yachts and boats. The flagship *Crescent* was decorated from the waterline to the trucks with incandescent lamps, showing plainly the shape of the hulls, as well as the masts, yards and funnels even more minutely than was done on H. M. S. *Blake*, when she was in New York. The other English and French warships and the cable ship, *Mackay-Bennett*, made wonderful displays with their searchlights and blue fire. The illuminated procession had a very pleasing effect, the steamers and yachts being decorated with all sorts of lights. The steamer *Annie*, on which had been placed a special engine and dynamo with strings of incandescent lamps, covered with fancy shades and Wheeler reflectors, presented a very handsome effect, This installation was the work of John Starr, Son & Co., Ltd., Halifax, who had a party of friends on board, among whom was Mr. S. A. Chase, of the Western Electric Company, New York.

The Electric Railway.

NIAGARA FALLS, N. Y.—The Gorge Road has secured a site in this city for the erection of a car-house.

SCHUYLKILL, PA.—The Schuylkill Electric Railway Company will complete the Schuylkill Haven Branch.

RUTLAND, VT.—The Rutland Electric Railway Company expects to extend its road in the near future.

PORT RICHMOND, S. I., N. Y.—The Midland Railway has received permission to lay a double track in Richmond Road, from Broad to Oak Street.

SOMERVILLE, N. J.—Work will be commenced about Sept. 1, on the construction of the trolley line from Somerville to Bound Brook and thence to New Brunswick.

BALTIMORE, MD.—The first branch of the City Council passed an ordinance authorizing the Central Railway Company to use compressed air as a motive power on its lines.

YPSILANTI, MICH—The Ann Arbor & Ypsilanti Street Railway Company has been granted a franchise by the Ypsilanti and Pittsfield town boards to use electric power.

WORCESTER, MASS.—There is another movement on foot for a street railway between Worcester and Clinton. Among the promotors are Hon. T. C. Bates and William J. Hogg.

LANSINGBURG P. O., TROY, N. Y.—At a special meeting of the Lansingburgh Trustees, an application of the Troy City Railway Company, to extend its lines was considered.

ALTOONA, PA.—A company of Altoona and Pittsburg capitalists has been formed for the purpose of connecting Altoona and Ashville, Cambria County, by an electric railway nine miles long.

UNIONTOWN, PA.—The Uniontown Electric Railway Company will extend its lines to Fair Chance, a distance of six miles. It is expected to have the new line ready for business by Oct. 15.

PORTLAND, ME.—The Portland Street Railway Company has petitioned the Deering City Government for permission to lay double tracks from a point on Forest Avenue to different streets throughout the city.

IPSWICH, MASS.—The construction of an electric road to connect Rowley, Georgetown and Haverhill with Ipswich is contemplated in the near future. President Ferguson, of the G. E. I. & B. road, is interested.

GREENBUSH P. O., ALBANY, N. Y.—The proposed railway between Greenbush and Nassau is to be incorporated. L. N. S. Miller, W. H. Nichols, J. P. Van Ness and Gardner Morey have the matter in hand.

BRADDOCK, PA.—The Braddock Electric Street Railway Company, which has been out of operation since Spring, will at once begin the construction of its line to Bessemer Terrace. The line is to be completed by November.

MEDWAY, MASS.—The Milford, Holliston & Framingham Street Railway Company will probably apply for a franchise in Medway at once, the route to be from Milford, through Caryville, to Medway *via* Village or High Street.

BROOKLYN, N. Y.—A new syndicate, known as the Brooklyn, Newtown, Jamaica & Flushing Railway Company, has been organized with a view to establishing trolley lines between Brooklyn and the north shore of Long Island as far as Great Neck. N. R. Appleton, of New York, is president of the syndicate, and B. F. Frick, formerly associated with the Atlantic Avenue system, Brooklyn, secretary.

ELIZABETH, N. J.—John D. Crimmins, of New York, and B. M. Shanley, of Newark, will, in all probability, abandon the project of building a trolley road between Elizabeth and Westfield. The unwillingness of the county authorities to allow them the use of the macadam road between the two places is given as the reason. The county authorities are loath to give up the macadam road to any trolley company. It is now believed that Riker Bros., of Newark, will apply for the franchise.

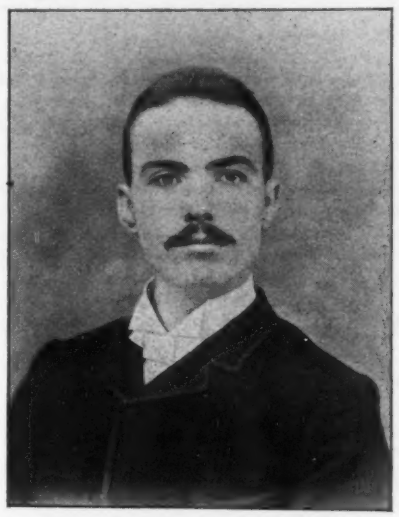
BROOKLYN, N. Y.—The Brooklyn Heights Electric Railway Company, through its secretary and treasurer, Mr. T. S. Williams, has tendered to the free use of the *Tribune* Fresh Air Fund two of its large, open cars during the hot season. The trolley cars are to be placed at the disposal of the fund managers and will be run over any of the company's lines which the conductors of the party may designate. It is hoped that by this generous offer the poor residents of the tenement-house districts will avail themselves of the opportunity to thus enjoy a few hours in the fresh air. The rides will usually occupy about three hours.

TRENTON, N. J.—A syndicate of capitalists has just been organized to construct and operate an electric railway across the State of New Jersey and connecting Philadelphia and New York. Mr. Joseph Canby, of Philadelphia, is said to be at the head of the enterprise, and it is stated that contracts amounting to $475,000, for the construction of a part of the road in the neighborhood of Bound Brook and New Brunswick, have been entered into, and a $100,000 power-house is to be built at Bound Brook. The name of the new company is the New York & Philadelphia Traction Company, and associated with it is the Central Jersey Traction Company.

Personal Notes.

MR. F. T. EGGARS, managing director of the Electrical Company, of London, the English branch of the Allgemeine Elektricitats-Gesellschaft, of Berlin, gave a four-in-hand drive and luncheon in the country, on Aug. 4, to the principal employees of the Electrical Company and a few other invited guests. The distance was to Boxhill, 30 miles from London, and return, and the outing was thoroughly enjoyed by every one who participated, particularly as the host did the driving. There was a surprise connected with the trip for Mr. Eggars, for his employees took advantage of the occasion to present him with an elegant gold split-second stop watch "as a small token of their united esteem."

MR. THOMAS J. FAY, general manager of the C. & C. Electric Company, New York, was born in Elgin, Ill., on March 14, 1866, and received his education in the public schools and by private tuition. At the age of 18 years, and at the time when electric lighting began to be developed, he became manager of the Elgin Electric Illuminating Company. Two years later—in 1886—he left his native town to accept the position of manager of one of the stations of the Chicago Arc Light & Power Company. In 1888 Mr. Fay became general superintendent of the Brooklyn Incandescent Electric Light Company, and established 11 storage-battery plants, the largest having 150 batteries of 32 cells each. One year later he was appointed general inspector of the Edison Electric Illuminating Company, Brooklyn, N. Y., and during 1890 was engaged in miscellaneous engineering projects. In 1891 Mr. Fay became associated with the C. & C. Electric Company, in the capacity of salesman, and in 1892 was appointed the New York sales agent for the same company, which position he filled during 1893, when he was advanced to a position in the technical department at headquarters. Mr. Fay, through his close attention to details, became general superintendent of the C. & C. Company's works in 1894, and filled the position through 1895. In 1896 he was appointed general manager of the company, which position he now fills very satisfactorily to the company. It may be said to Mr. Fay's credit that the advanced position attained by the C. & C. Company in the electrical industry was brought about largely through his enterprise, experience and skill. Mr. Fay is an inventor of considerable note, having taken out about 50 patents on electrical machinery. He has besides contributed special technical articles to the electrical press, which have attracted attention through his directness in stating technical facts. A considerable part of the C. & C. Company's apparatus is of Mr. Fay's design.



Thomas J. Fay.

MR. CHARLES J. GLIDDEN, treasurer of the Erie Telephone Company, was a passenger on the American Line steamer *St. Paul*, which arrived at New York Friday, Aug. 14, after the fastest passage ever made between Southampton and New York. Mr. Glidden is one of the most prominent men connected with the telephone business, and it will interest many readers of The Electrical World to know how he came to identify himself with that branch of electrical progress. As a telegraph operator at Manchester, N. H., he was anxious to report every fire that occurred in Manchester, because the Boston dailies paid one cent a word for the telegrams, and this increased the receipts of his office. He rigged up an electrical contrivance connected with fire headquarters, which raised the clothing from his bed on the first signal of a fire. He had a combined suit of clothing and rubber boots all ready at the side of his bed, and has always maintained that he was on the street 30 seconds after the alarm of fire was sounded, and for the good work he did in thus augmenting the receipts of his office, his salary was increased from $40 a month to $125. When Prof. Bell gave his first exhibition of the telephone in Manchester he arranged with Mr. Glidden to run a wire to the hall where the demonstration was to take place. Mr. Glidden ran two. Prof. Bell inquired the reason. Mr. Glidden said that in case one wire should give out the experiments could still go on. Prof. Bell remarked that in all his experience nobody else had ever given him two wires when he asked for one, though on several occasions accidents had happened and audiences been disappointed. He told the young telegrapher that if he could ever be of service to him he would be glad. He kept his word. When Mr. Glidden desired to enlarge the scope of his work, and wished a license from the Bell Company, Prof. Bell aided him. Mr. Glidden says he was the first man to organize a list of subscribers to a telephone exchange. This was at Lowell, Mass. He admits, however, that the New Haven exchange was in operation before his. Mr. Glidden has since lived in Lowell, and has gained wealth and reputation, both of which he richly deserves.

Obituary Notes.

MR. EDWARD MAY, president of the Mount Morris Electric Light Company, New York, suddenly died at his office at Van Dam and Greenwich Streets, on the evening of Aug. 10.

MR. ELIAS R. POPE, president of the Plainfield Electric Light Company, Plainfield, N. J., died at his home in that city on Aug. 10, at the age of 65 years.

M.r Pope was one of the best-known bankers in New Jersey, and was prominently identified with some of the principal financial and industrial concerns in Plainfield.

Trade and Industrial Notes.

THE VILTER MANUFACTURING COMPANY, late the Weisel & Vilter Manufacturing Company, Milwaukee, Wis., has just issued a catalogue of its Corliss engines.

THE AMERICAN ELECTRIC HEATING CORPORATION, Boston, Mass., in a pamphlet just issued for 1896-97, describes and illustrates its new American electric car heaters.

MR. JAMES G. BIDDLE, 944 Drexel Building, special agent for the Weston Electrical Instrument Company, handles a complete line of voltmeters, ammeters and wattmeters made by this company. His catalogue "X" has proved of much help to buyers.

THE GENERAL ELECTRIC COMPANY will soon put out a small illustrated booklet on its long-burning arc lamps. The subject is treated from the standpoint of the convenience and economy of the station manager and customer. Copies will be ready for distribution in a few days, and our readers may obtain the same by applying to any of the offices of the company.

WATERTOWN ENGINES.—Among the sales of engines by the Watertown Steam Engine Company, Watertown, N. Y., during the month of July, are the following: One compound condensing engine, direct-connected to Westinghouse generator, for the Ohio State University, Columbus; one direct-connected to Eddy generator, for the Cameron Apartment House, New York; three vertical compound condensing engines, direct-connected to Eddy generators, for the Pope Bicycle Manufacturing Company, Hartford, Conn.; one single direct-connected to General Electric dynamo, for the Hotel Stafford, Baltimore, Md ; one single cylinder, direct-connected to Siemens & Halske generator, for the Roosevelt Hospital, New York; two direct-connected to Walker generators, for the Windsor Hotel, New York; two direct-connected to Siemens & Halske generators, for the Chemical Building, St. Louis.

THE BALL ENGINE COMPANY, Erie, Pa., reports the following among recent installations: Ohio State Reformatory, Mansfield, O., two 150-hp engines, direct-connected to Card dynamos; Aberdeen Electric Light Company, Aberdeen, Miss., one 100-hp engine; Carpentersville, Elgin & Aurora Railway Company, Elgin, Ill., one 400-hp vertical compound condensing engine, direct-connected to General Electric Company generator; electric light plant, Ovid, N. Y., one 70-hp compound engine and steam plant complete; Edison Electric Illuminating Company, Baltimore, Md., one 300-hp cross-compound engine; McIntosh, Hemphill & Co., Pittsburg, Pa., one 100-hp engine, direct-connected to Westinghouse generator; Crocker-Wheeler Electric Company, Versailles, Pa., one 150-hp engine; Western Electric Company, Janesville, Wis., one 40-hp engine; Danville Street Car Company, Danville, Va., one 150-hp engine; Mohawk Building, Cleveland, O., three 50-hp engines, direct-connected to Walker dynamos; Harper Hospital, Detroit, Mich., two 70-hp engines, direct-connected to General Electric dynamos; Mt. Washington Electric Light & Power Company, Mt. Washington, Md., one 100-hp engine; Tremont Building, Boston, Mass., one 100-hp and one 50-hp, direct-connected to General Electric dynamos.

SILEX INSULATION.—The Silex Insulation Company, 39 and 41 Cortlandt Street, is now introducing to the electrical trade its new system of electric insulation. The company uses powdered silex as the insulating material, packing it tightly around the conductor, which is carefully centralized inside of iron pipe. The joints between the lengths of pipe are of the best character, rendering it impossible for moisture to penetrate into the interior. The outlets are hermetically sealed with a mica cap and shellac. The pipe, when packed with the silex, is capable of being bent without decentralizing the conductor. The properties of silex are such as to render it of exceptional value as an insulator. As a non-conductor of heat it is remarkable. Tests in the presence of a representative of THE ELECTRICAL WORLD demonstrated very conclusively the value of the substance in this particular. It is stated that tests have been made where the conductor was fused within the silex insulation, and when the current was withdrawn the fused metal solidified, again restoring the continuity of the conductor. This experience proved, it is claimed, the infusibility of the silex and the closeness with which it can be packed in the tube. It is said to be non hygroscopic, no moisture whatever being detectable under conditions which are usually considered the severest for hygroscopic tests. This quality insures a perfectly dry insulating substance. Mr. F. G. Nash is the inventor of this system. His office is at the address given.

Business Notices.

The illustrations in this issue were made by the Photo-Engraving Company 67-71 Park Place, New York.

BATTERY CUT-OUT CHEAP.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 15 South Warren Street, Syracuse, N. Y.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED AUG 11, 1896.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

565,453. ELECTRIC RAILWAY; Wm. Gounow, Jr., Bridgeport, Conn. App. filed Aug. 27, 1895. The combination in a closed conduit for electrical railways, the bottom of which is filled in with asphaltum, the upper surface of which is inclined to form a gutter, of an electrical conductor supported centrally in said conduit, and insulated therefrom, and a flexible curved cover for said conduit, a depressible rail, disposed between said elastic cover and insulated therefrom, substantially as described.

565,518. RAILWAY CROSSING SIGNAL; J. Shoecraft, Harveyville, Kan. App. filed Sept. 17, 1895. A crossing-signal for railways, comprising a signal located at the crossing, a motor for operating the signal, a circuit-breaker at each side of the crossing, a normally-closed electric circuit comprising a circuit-wire extending from one to the other of said circuit-breakers, a battery, a second circuit-wire extending from one to the other of the circuit-breakers, and an electromagnet for controlling the motor, means comprising a lever co-acting with a lug on one of the motor-wheels for releasing the motor for a complete operation of the signal upon the operation of one circuit-breaker by a passing train, and means comprising a lever and a notched disc for setting the motor for subsequent operation upon the operation of the second circuit-breaker by said passing train, substantially as specified.

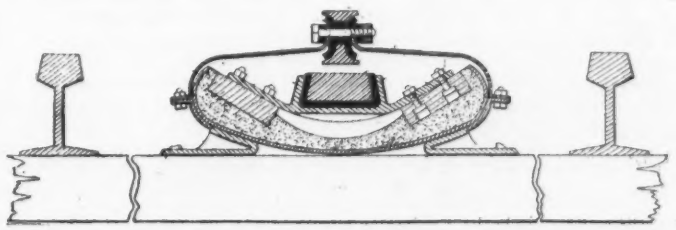
565,529. DYNAMO-ELECTRIC MACHINE; E. Caemmerer and F. G. Mayer, Chicago, Ill. App. filed Dec. 4, 1895. In a dynamo-electric machine, a field-magnet comprising a core provided with pole-shoes, a sleeve adapted to contain said core and having an equal number of pole-shoes therewith, and non-magnetic material interposed between said pole-shoes of said core and said sleeve, whereby the magnetic lines of force generated in said core will be caused to pass through the armatures before completing the circuit through said sleeve.

565,530. DYNAMO-ELECTRIC MACHINE; E. Caemmerer and F. G. Mayer, Chicago, Ill. App. filed Dec. 4, 1895. In a dynamo-electric machine a field-magnet comprising an outer casing, and a core situated within said casing and supported upon non-magnetic supports, substantially as described.

565,541. SOCKET FOR INCANDESCENT LAMPS; H. Hubbell, Fairfield, Conn. App. filed June 6, 1896. In a device of the character described, the combination with an insulating-block having inclines, one of said inclines being provided with a plate which is electrically connected with one of the binding screws, of a rotatable contact-plate electrically connected with the other binding-screw and having downwardly extending arms which are adapted to engage the inclines and plate, a rotatable operating-plate which is adapted to engage the contact-plate each time it is actuated to move the contact-plate forward and place one of the arms either in contact or out of contact with plate, and a spring acting to retain the operating-plate and the contact-plate in operative position and to return the operating-plate to its normal position after each actuation.

565,571. ELECTRIC CIGAR LIGHTER; F. W. Schindler-Jenny, Kennelbach, Austria, Hungary. App. filed Oct. 2, 1895. In a cigar or pipe lighting apparatus, the combination of a casing, a frame consisting of a plate or block and supporting-studs fixed thereto, a glow-wire carrier separable from and adapted to lie above and be supported by the said studs, and means for connecting the frame and to the casing and keeping the glow-wire carrier in close contact with its supporting-studs, all substantially as set forth, and for the purposes specified.

565,574. ELECTRIC HEATER; R. Van R. Sill, Cleveland, O. App. filed March 20, 1896. The combination of a hermetically sealed radiator having vertical chambers communicating with each other at their upper ends, a comminuted resistance filling said radiator, and an electrode extending into the lower end of each chamber, and having contact with the resistance material, substantially as described.



No. 565,453.—ELECTRIC RAILWAY.

565,624. ELECTRIC CONDUIT RAILWAY; J. B. Linn, Cleveland, O. App. filed Jan. 11, 1895. In electric railways, a wooden box constructed to be filled with oil, and located at the side of the track and having double ends, and a contact-block in each end provided with spring contact-points and a switch in said box, substantially as set forth

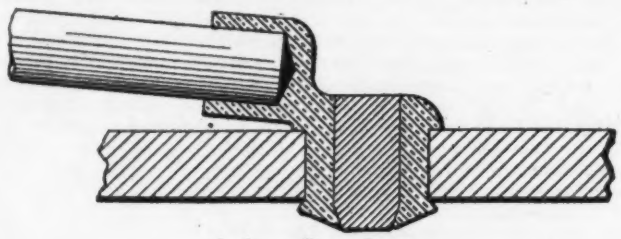
565,627. TELEPHONE EXCHANGE SYSTEM; A. F. W. Meyer, Blue Island, Ill. App. filed Aug. 8, 1895. In a telephone-exchange system, the combination with the switchboard, the contact-plugs thereof and the wires connecting the subscribers' lines with said plugs, of conducting-levers bearing toward their free ends on said wires to hold them separate and taut, and forming electrical connections between said lines and connecting-wires, substantially as described.

565,647. ARMATURE FOR DYNAMO-ELECTRIC MACHINE; D. P. Thomson and A. H. Armstrong, Schenectady, N. Y. App. filed May 13, 1896. An armature for a dynamo-electric machine, comprising a core having slots the sides of which are parallel with the radii passing through their centres, L-shaped teeth having undercut portions, coils each occupying an aliquot

portion of the slot, and wedges engaging with the undercut portion of the teeth for retaining the coils in place.

565,657. PHOTOGRAPHIC TELEGRAPH RECORDER; C. Ader, Paris, France. App. filed Oct. 24, 1895. A permanent magnet having apertures in the longitudinal centre of its pole-pieces, a source of light opposite one of said apertures, and a sensitized traveling band opposite the other aperture, in combination with a stretched vibrating wire in the magnetic field between and longitudinally of said pole-pieces, adapted to be traversed by the current of a telegraphic line, and deflected according to such current, and a stationary slotted screen between said material and source of light, said screen confining the flow of light to said material to the portion thereof opposite its slots, and said wire interrupting such flow and casting a shadow through such slot onto said material, whereby the deflection of the wire can be photographed thereon.

565,662. ELECTRIC SWITCH; C. Bach, Jr., Milwaukee, Wis. App. filed Nov. 11, 1895. A knife-switch comprising a plurality of blades united by a non-conductive bar, a bracket extending rearward from the bar, a handle in pivotal connection with the bracket, and another bracket on said bar, at a right angle to the one aforesaid, provided with a longitudinal slot engaged by the handle.



565,672.—Rail Bond.

565,672. RAIL-BOND; F. H. Daniels, Worcester, Mass. App. filed June 20, 1896. A rail-bond terminal or end, provided with an opening for a drift-pin or taper-tool, said opening of enlarged diameter at one end, and of reduced diameter at the other end, and the intermediate portion cylindrical or of uniform diameter, with taper or inclined portions connecting the same with said ends, substantially as described.

565,673. ELECTRIC SWITCH; W. L. Denio, Rochester, N. Y. App. filed Jan. 25, 1894. The combination of a movable circuit-closer driven by suitable mechanism, a conducting-ring provided with breaks, forming segments over which the circuit-closer rests, a main circuit connected with the conducting ring, a magnet for controlling the mechanism that operates the circuit-closer, a second magnet provided with suitable attachments for locking the armature of the first magnet and permanently restraining the operating mechanism, and suitable electrical connections controlling the magnets, as described.

565,725. TROLLEY-WHEEL; J. B. Dailey, Philadelphia, Pa. App. filed Oct. 22, 1895. In a device of the character described, a fork having secured in its extremity a shaft-rod, a coil-spring arranged around said shaft, a trolley-wheel and two grooved pulleys, one upon either side of said wheel, journaled upon said shaft, and contact springs, adapted to bear against the ends of said pulleys, as shown and specified.

565,727. CHARGING AND DISCHARGING SECONDARY BATTERIES; E. N. Dickerson, New York City. App. filed May 26, 1892. The combination of a secondary battery, an automatic switch for connecting its cells in series or multiple, a source of electricity connected with said switch, and mechanism for automatically cutting off the source of electricity and shifting the battery-switch from multiple to series when the desired potential of the battery has been reached, substantially as described.

565,739. ELECTRICALLY OPERATED STRINGED MUSICAL INSTRUMENT; W. H. Gilman, Boston, Mass. App. filed July 21, 1894. A stringed musical instrument comprising in its construction the sounding-board or head having guide-bars extending across the face thereof parallel with the strings, slide-bars extending through the guide-bars and provided with pickers at one end, electromagnets at the side of the head and having their armatures connected with said slide-bars, the fretted neck having perforations and a plurality of electromagnets secured to the rear side of said neck, and fingers connected with the armatures of said magnets, and extending through and guided by said perforations, the ends of said fingers being extended over the strings between the frets, substantially as described.

565,740. SYSTEM OF ELECTRICAL DISTRIBUTION; F. D'A. Goold, New York City. App. filed Nov. 2, 1895. The combination of a circuit conveying or adapted to convey a high-tension continuous current, a series of storage-cells in sections or groups, all of which cells are continuously connected in series to said high-tension circuit, a consumption-circuit requiring a current of lower tension than the charging-current, and a circuit changer for connecting the cells in section successively to the consumption-circuit and disconnecting them therefrom.

565,741. STORAGE BATTERY SYSTEM; F. D'A. Goold, Brooklyn, N. Y. App. filed Feb. 27, 1896. The combination of a charging-circuit having, or adapted to have, a source of direct-current connected thereto, a discharge-circuit, a definite number of groups of storage-cells always (when the system is in use) connected in series to the discharge-circuit, a commutator device and circuit connections for connecting the groups of cells successively to the charging-circuit, and an automatic-maker in the charging circuit operated by the closing of the discharge-circuit.

565,761. ELECTRIC TIME ALARM; H. E. Lipscomb, Richmond, Va. App. filed June 18, 1896. In an electric time-alarm the combination of a circuit-closing clock, and an alarm mechanism, said mechanism consisting of a casing, a disc thereon, a revoluble shaft, a contact-arm carried by said shaft and adapted to travel around the dial, a series of pins in the path of the contact-arm, said pins being insulated from each other, an alarm-circuit connected to said arm, another shaft, contact-arm carried thereby, said arm being adapted to bear on the other ends of the series of pins, means electrically connected to the circuit-closing clock for intermittently revolving this shaft, an alarm-circuit connected to this latter contact-arm and to a source of supply, substantially as described.

565,775. ADVERTISING ELECTRICAL PHOSPHORESCENT LETTERS OR SIGNS; D. McF. Moore, New York City. App. filed Jan. 7, 1895. The combination of an electrical conductor shaped into a letter or sign, an evacuated inclosure containing the conductor, and means for interrupting and closing the electric conductor within the enclosure.

565,776. PHOSPHORESCENT ELECTRICAL ILLUMINATION BY METALLIC COATING UPON GLASS; D. McF. Moore, New York City. App. filed Jan. 24, 1895. A phosphorescent illuminator, consisting of the combination of an evacuated enclosure, a metallic coating formed upon the interior surface thereof, relatively yielding electric terminals within the evacuated enclosure, an electric conductor connecting one of the terminals with the coating, and means for rapidly alternately opening and closing the terminals.

565,777. PHOSPHORESCENT ELECTRICAL ILLUMINATION BY SECONDARY CURRENTS; D. McF. Moore, New York City. App. filed Jan. 24, 1895. The combination with an evacuated enclosure, of a conductor located therein and forming part of a secondary circuit with reference to a given primary circuit, and means for alternately interrupting and closing the secondary circuit within the vacuum.

565,811. SWITCHBOARD FOR ELECTRICAL DISTRIBUTION SYSTEMS; L. B. Stillwell, Pittsburg, Pa. App. filed Aug. 6, 1895. The combination with two sets of cylindrical bus-bars, each of which comprises a plurality of sections differing in size and joined end to end, of a series of feeder-switches and a series of dynamo-switches connected alternately to said bus-bars and means for actuating said switches.

565,823. MULTIPLE SWITCHBOARD; R. McAndrews, Richmond, Va. App. filed April 17, 1896. In a multiple switchboard, the combination with a suitable apertured board divided into sections, a small test-spring below each aperture, an electrical connection between all of said springs, a sounding device in said circuit between each section, a large test-spring also mounted below each aperture and adapted to be brought into contact with its respective test-spring by the insertion of a plug, electrical connections between all of said large test-springs representing the same subscriber, contacting springs also mounted below each aperture, suitable circuit-wires for connecting them to the telephones, and connected plugs for insertion in said apertures, substantially as described.

565,839. AUTOMATIC SIGNAL; J. P. Coleman, Edgewood Park, Pa. App. filed June 1, 1896. In a signalling system, the combination of a track-section, a signal controlling the movement of trains along such section, mechanism controlled by the movement of trains to shift said signal to "caution," and mechanism controlled by the caution mechanism to shift said signal to "danger," substantially as set forth.

565,861. ELECTRIC-ARC LAMP; J. A. Mosher and William S. Bartholomew, Chicago, Ill. App. filed Sept. 23, 1895. In an arc lamp, the combination with a frame having vertical guide-rods, of a carbon holder adapted to slide upon the guide-rods and having a knife-edge bearing thereupon, substantially as described and for the purpose specified.

565,725.—Trolley Wheel.

565,862. FITTING FOR INCANDESCENT ELECTRIC LAMPS; J. McFarlane, Glasgow, Scotland, and W. B. Edgar, Partick, Scotland. App. filed June 27, 1894. In a combination with the movable contact having a tread arranged for engagement on opposite sides, and the oppositely acting wedge engaging alternately with opposite sides of the tread and mounted upon an axially moving key arranged transversely to the movement of the contact, substantially in the manner set forth.

565,867. CUT-OUT FOR ELECTRIC MOTORS; E. P. Warner, Chicago, Ill. App. filed March 5, 1895. In a motor cut-out, the combination with a rheostat included in the armature-circuit and provided with a contact-arm adapted to be moved to cut in and out resistance, of a switch in said armature-circuit, independent of said contact-arm, a responsive device included in the motor-circuit and adapted to maintain said switch normally closed and to effect the opening of the same when the current through the motor ceases, said rheostat contact-arm being adapted, when moved, to cut in the starting resistance, to close said switch, whereby the starting of the motor without cutting in the starting resistance is prevented.